PAUL L. REDFEARN JR.

FLORA OF SOUTHERN AFRICA

BRYOPHYTA

Editor O. A. Leistner

Part 1 Mosses

Fascicle 2

Gigaspermaceae—Bartramiaceae

by Robert E. Magill

Botanical Research Institute
Department of Agriculture and Water Supply
Republic of South Africa

FLORA OF SOUTHERN AFRICA

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FLORA OF SOUTHERN AFRICA

BRYOPHYTA

PART 1, FASCICLE 2

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Dedicated to the memory of

EDMUND ANDRÉ CHARLES LOUIS ELOI SCHELPE

Bryologist

1924–1985

FLORA OF SOUTHERN AFRICA

which deals with the territories of

SOUTH AFRICA, TRANSKEI, LESOTHO, SWAZILAND, BOPHUTHATSWANA,
SOUTH WEST AFRICA/NAMIBIA, BOTSWANA AND VENDA

BRYOPHYTA

PART 1 MOSSES

Fascicle 2 Gigaspermaceae–Bartramiaceae

by

Robert E. Magill

Edited by

O. A. Leistner

Editorial Committee: B. de Winter, D. J. B. Killick, G. E. Gibbs Russell and O. A. Leistner

Botanical Research Institute,
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CONTENTS

	Page
New taxa and new combinations published in part 1, fascicle 2	vi
Geographical regions referred to in this fascicle	vii
Introduction to fascicle 2	ix
Conspectus of classification	293
Literature cited	294
Provisional key to the families of fascicle 2	296
GIGASPERMACEAE	299
EPHEMERACEAE	305
FUNARIACEAE	311
SPLACHNACEAE	331
BRYACEAE (by J. van Rooy & R. E. Magill)	335
MNIACEAE	395
EUSTICHIACEAE	399
RHIZOGONIACEAE	401
AULACOMNIACEAE	405
BARTRAMIACEAE	407
Index to fascicle 2	439

NEW TAXA AND NEW COMBINATIONS PUBLISHED IN PART 1 FASCICLE 2

Anacolia breutelii (*C. Müll.*) *Magill,* comb. nov., p. 411

Anacolia breutelii (*C. Müll.*) *Magill* var. **squarrifolia** (*Sim*) *Magill,* stat. nov., p. 412

Bartramia compacta *Hornsch.* var. **macowaniana** (*C. Müll.*) *Magill,* stat. nov., p. 413

Breutelia elliptica *Magill,* sp. nov., p. 435

Breutelia substricta (*C. Müll.*) *Magill,* comb. nov., p. 437.

Ephemerum namaquense *Magill,* sp. nov., p. 307

Funaria clavata (*Mitt.*) *Magill,* comb. nov., p. 326.

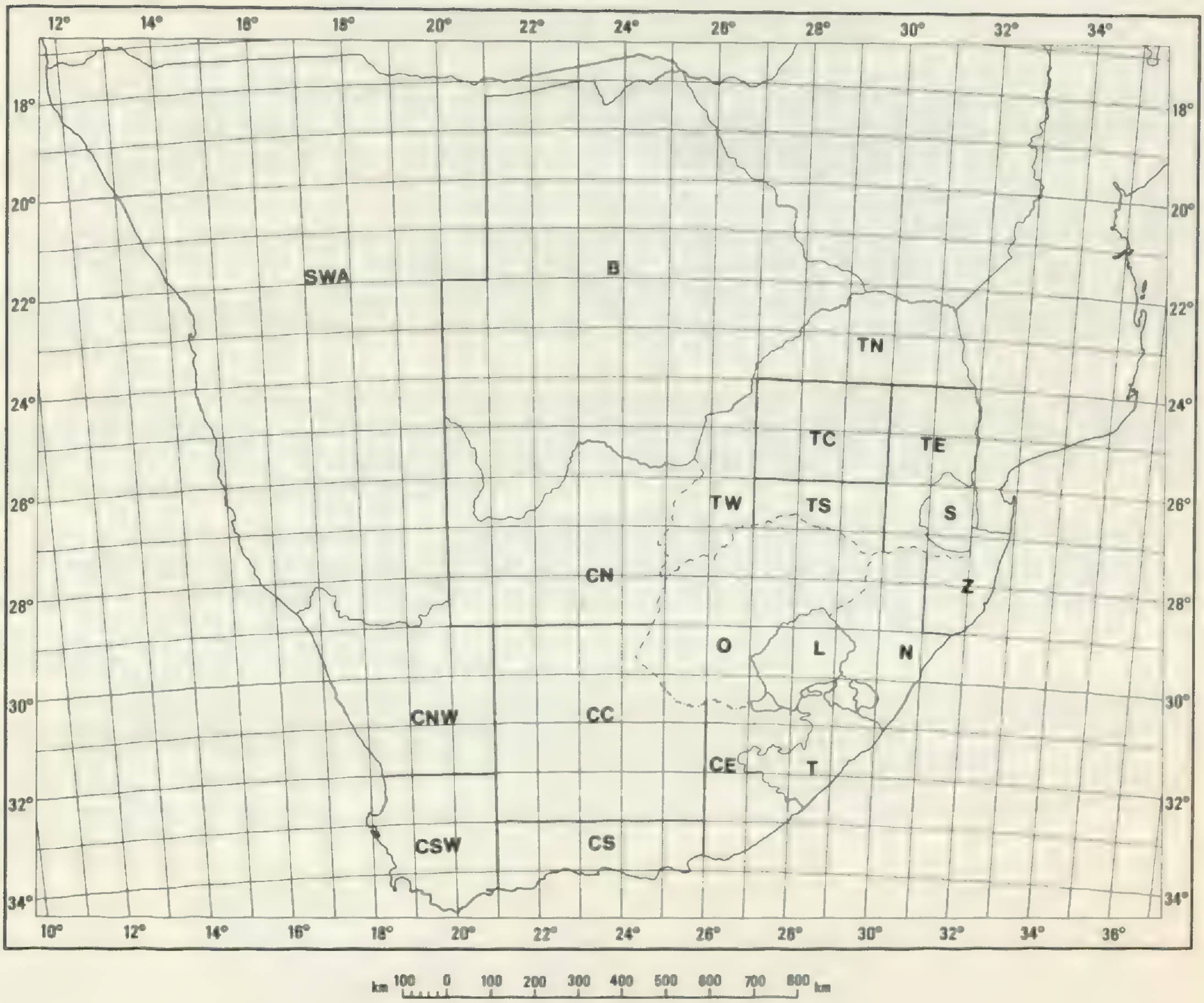
Funaria succuleata (*Wager & Wright*) *Magill,* comb. nov., p. 321

Physcomitrium spathulatum (*Hornsch.*) *C. Müll.* var. **sessile** (*Shaw*) *Magill,* stat. nov., p. 319

Quathlamba *Magill,* gen. nov., p. 421

Quathlamba debilicostata *Magill,* sp. nov., p. 421

Date of publication: July, 1987.



GEOGRAPHICAL REGIONS REFERRED TO IN THIS FASCICLE

B—Botswana

CC—central Cape

CE—eastern Cape

CN—northern Cape

CS—southern Cape

CNW—northwestern Cape

CSW—southwestern Cape

L—Lesotho

N—Natal

O—Orange Free State

S—Swaziland

SWA—South West Africa/Namibia

T—Transkei

TC—central Transvaal

TE—eastern Transvaal

TN—northern Transvaal

TS—southern Transvaal

TW—western Transvaal

Z—Zululand

INTRODUCTION TO FASCICLE 2

The following text constitutes Fascicle 2 of Part 1 of **Volume Bryophyta** in the Flora of southern Africa Cryptogam series. This fascicle includes the families Gigaspermaceae to Bartramiaceae or roughly the Acrocarpi-diplolepideae (see Conspectus of classification, p. 293).

The notes on *Study and identification* and *Characters used in keys and description of mosses* from Fascicle 1 also apply here. One important difference is that most of the species in Fascicle 2 have double peristomes, i.e. exostome and endostome (see Glossary and Fig. 2: 3 of Fascicle 1). Occasionally only one of these structures is present e.g. *Conostomum* (exostome only) or the capsules of some species are gymnostomous. The capsules in only a few species in this fascicle are cleistocarpic.

Variation in the structure and development of the endostome is quite common in members discussed in this fascicle. This variation is expressed in (1) height of the basal membrane, (2) structure and height of the segments especially in relation to the exostome teeth, and (3) development, number and height of the cilia.

Although the endostome can be examined using the method for observing capsule mouth parts outlined in Fascicle 1, observation can be enhanced by carefully teasing the endostome away from the exostome teeth on one or two of the mouth sections. Some of the mouth sections should be left intact since differences in height of endostome and exostome, and position of segments in relationship to teeth (opposite or alternate) are occasionally important.

The illustrations were prepared by Mrs Rita Weber and Ms Gillian Condy; for technique and procedure see Introduction in Fascicle 1 (p.xv).

Research on this fascicle was partly supported by grants to the Missouri Botanical Garden from the National Science Foundation (BSR−8315245) and the National Geographic Society (2719−83).

Erratum in Part 1 Fascicle 1:

Page 225: in the caption of Map 86 *Weisiopsis pulchriretis* and *Weisiopsis involuta* must be switched.

CONSPECTUS OF CLASSIFICATION

DIVISION BRYOPHYTA

Fascicle 1:

CLASS SPHAGNOPSIDA
ORDER SPHAGNALES
Family Sphagnaceae

CLASS ANDREAEOPSIDA
ORDER ANDREAEALES
Family Andreaeaceae

CLASS BRYOPSIDA
ORDER DICRANALES
Family Fissidentaceae
Nanobryaceae
Archidiaceae
Ditrichaceae
Seligeriaceae
Dicranaceae

ORDER POTTIALES
Family Calymperaceae
Encalyptaceae
Pottiaceae
Bryobartramiaceae
Grimmiaceae

Fascicle 2:

ORDER FUNARIALES
Family Gigaspermaceae
Ephemeraceae
Funariaceae
Splachnaceae

ORDER BRYALES
Family Bryaceae
Mniaceae
Eustichiaceae
Rhizogoniaceae
Aulacomniaceae
Bartramiaceae

Fascicle 3:

ORDER ORTHOTRICHALES
Family Erpodiaceae
Rhachitheciaceae
Ptychomitriaceae
Orthotrichaceae
Rhabdoweisiaceae
Racopilaceae

ORDER ISOBRYALES
Family Fontinalaceae
Wardiaceae
Hedwigiaceae
Cryphaeaceae
Leucodontaceae
Prionodontaceae
Trachypodaceae
Pterobryaceae
Meteoriaceae
Phyllogoniaceae
Neckeraceae
Lembophyllaceae

ORDER HOOKERIALES
Family Hookeriaceae

Fascicle 4:

ORDER THUIDIALES
Family Fabroniaceae
Leskeaceae
Thuidiaceae

ORDER HYPNOBRYALES
Family Amblystegiaceae
Brachytheciaceae
Entodontaceae
Plagiotheciaceae
Hypnaceae
Hylocomiaceae

CLASS POLYTRICHOPSIDA
ORDER POLYTRICHALES
Family Polytrichaceae

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PROVISIONAL KEY TO THE FAMILIES OF FASCICLE 2

The following key is provided to allow access to the families treated in this fascicle. This key is a continuation of the family key in Fascicle 1 and should be used in connection with it. When necessary, couplets are incorporated into the key that refer to taxa which will be treated in other fascicles.

1 Plants pleurocarpic or of pleurocarpic habit ..... (Fascicle 3 & 4)

1 Plants acrocarpic or appearing acrocarpic but branches arising from a creeping stem or rhizome:

2 Plants with a creeping stem or rhizome:

3 Plants forming dense mats or cushions on rock or bark; leaf cells frequently papillose ..... **ORTHOTRICHACEAE** (Fascicle 3)

3 Plants scattered or forming large turfs on soil; leaf cells smooth:

4 Plants small to medium-sized; leaf margins entire, without differentiated marginal cells; capsules immersed to short-exserted ..... **GIGASPERMACEAE** (p. 299)

4 Plants large to robust; leaf margins denticulate to dentate, marginal cells differentiated and forming distinct border; capsules long-exserted ..... **BRYACEAE** (p. 335)

2 Plants acrocarpic, without creeping stem or rhizome:

5 Leaves ecostate or costa rudimentary:

6 Plants minute, on dense, persistent protonema; leaves few, very small, margins dentate ..... **EPHEMERACEAE** (p. 305)

6 Plants small; leaves numerous, larger, margins entire:

7 Leaves orbicular-apiculate; costa absent; capsule immersed ..... **GIGASPERMACEAE** (p. 299)

7 Leaves ovate to elliptical, acute; costa absent to rudimentary; capsule exserted ... . **BARTRAMIACEAE** (p. 407)

5 Leaves costate:

8 Plants minute, usually on persistent protonema; capsules cleistocarpic, small, ± sessile and globose ..... **EPHEMERACEAE** (p. 305)

8 Plants larger, without persistent protonema; capsules stegocarpic *or,* if cleistocarpic, capsule not sessile and globose:

9 Leaves strongly toothed:

10 Leaves narrow with small, rounded leaf cells; costa percurrent ..... **RHIZOGONIACEAE** (p. 401)

10 Leaves broader with larger, ± rhomboidal leaf cells; costa short- to long-excurrent:

11 Marginal leaf cells differentiated, forming ± distinct border; marginal teeth unicellular ..... **BRYACEAE** (p. 335)

11 Marginal leaf cells not differentiated, marginal teeth generally multi-cellular ..... **SPLACHNACEAE** (p. 331)

9 Leaves serrate to entire:

12 Leaf cells papillose or prorate:

13 Leaves distichous, short and concave..... **EUSTICHIACEAE** (p. 399)

13 Leaves many ranked, elongated and flat ..... **BARTRAMIACEAE** (p. 407)

12 Leaf cells smooth:
14 Leaf with distinct border:
15 Leaves oblong to elliptical; apices rounded or emarginate..... ..... **MNIACEAE** (p. 395)
15 Leaf apices acute to acuminate or obtuse:
16 Alar cells differentiated, enlarged, in single row; border strong and extending to leaf base..... **BARTRAMIACEAE** (p. 407)
16 Alar cells not differentiated; border not distinct in leaf base:
17 Upper laminal cells with pointed ends, regular, ± rhomboidal..... **BRYACEAE** (p. 335)
17 Upper laminal cells mostly with flattened ends, not uniform, truncate-rhomboidal..... **FUNARIACEAE** (p. 311)
14 Leaves without distinct border:
18 Leaf cells rounded or angular, subquadrate to hexagonal:
19 Leaf margins serrate; laminal cells incrassate .... **AULACOMNIACEAE** (p. 405)
19 Leaf margins entire:
20 Upper laminal cells ± irregular in size and shape; walls firm, ± wavy; plants with rhizomes..... **GIGASPERMACEAE** (p. 299)
20 Upper laminal cells regular, hexagonal to subrectangular, thin-walled..... **FUNARIACEAE** (p. 311)
18 Leaf cells distinctly longer than broad, mostly rectangular or rhomboidal:
21 Upper laminal cells rectangular to linear-rectangular:
22 Leaves broad, widest at midleaf or above ..... **FUNARIACEAE** (p. 311)
22 Leaves narrow, widest at base:
23 Leaves linear-subulate above ovate base; costa broad, flattened in cross section; axillary tubers frequent..... **BRYACEAE** (p. 335)
23 Leaves ovate-lanceolate to linear-lanceolate; costa narrow, rounded in cross section; tubers absent..... ..... **BARTRAMIACEAE** (p. 407)
21 Upper laminal cells rhomboidal to oblong-rhomboidal; truncate-rhomboidal or fusiform:
24 Upper laminal cells with pointed ends, regular, rhomboidal to oblong-rhomboidal or fusiform ..... **BRYACEAE** (p. 335)
24 Upper laminal cells with ends generally flattened, not uniform, truncate-rhomboidal to rectangular ..... **FUNARIACEAE** (p. 311)

GIGASPERMACEAE

Plants small, scattered or loosely caespitose, glaucous green to light green or dark green; terricolous. *Branches* erect, arising from a long, highly branched, aphyllous rhizome; in section central strand weak or absent, cortical cells more or less uniform. *Leaves* appressed to erect spreading, generally concave, larger above, orbicular to broadly elliptical or obovate; apex rounded and abruptly apiculate or long-acuminate; margins plane, entire. *Costa* absent or, if present, short- to long-excurrent; in section cells not strongly differentiated. *Laminal cells* small, angular or quadrate to hexagonal, thin-walled, smooth; basal cells slightly larger, rectangular. *Gemmae* occasionally present at apex of leafy stems, lenticular.

Autoicous or dioicous with androgametophytes smaller. Perichaetia terminal, leaves generally distinct, larger. *Seta* very short or elongate; capsule immersed or exserted, cleistocarpic and subspherical or stegocarpic, gymnostomous and cupulate to short-cylindrical; exothecial cells lax, smaller and transversely rectangular at mouth; stomata present at base of urn; peristome absent; operculum plano-convex, apiculate; calyptra very small; spores large, granulate.

Known primarily from the Southern Hemisphere, Gigaspermaceae contains four genera. Only the American genus *Lorentziella*, recognized by its costate leaves and cleistocarpic capsules, is not represented in southern Africa.

Gigaspermum, with three species, is the most widely distributed genus and is found in Europe, Africa, Australia and New Zealand. *Chamaebryum* and *Oedipodiella* were both described from southern Africa. A variety of a species of the latter, *O. australis* (Wager & Dix.) Dix. var. *catalaunica* P. Varde, has been described from Europe.

Identification of plants with capsules or gemmae should not prove difficult; sterile plants, especially of *Oedipodiella* may be more problematical; however, detection of the rather copious rhizome system will properly place specimens in this family. It is interesting that in all three genera found in southern Africa the rhizome is light yellow to brownish, aphyllous and with only short, scattered rhizoids.

1 Leaves ecostate ..... 1. **Gigaspermum**

1 Leaves costate:

2 Costa excurrent as smooth, hyaline awn; capsule exserted ..... 2. **Chamaebryum**

2 Costa very short-excurrent; capsule immersed ..... 3. **Oedipodiella**

1. GIGASPERMUM

Gigaspermum *Lindb.* in Öfvers. K. VetenskAkad. Förh. 21: 599 (1865); Broth. in Natürl. PflFam. 10: 316 (1924); Sim, Bryo. S. Afr. 289 (1926); Sainsb., N. Zeal. Mosses 240 (1955). Type species: *G. repens* (Hook.) Lindb.

Plants small and inconspicuous when sterile; terricolous. *Branches* erect, leafy, simple, scattered along leafless rhizome. *Leaves* small, distant, rounded with abruptly apiculate apices, ecostate. *Laminal cells* small, thin-walled.

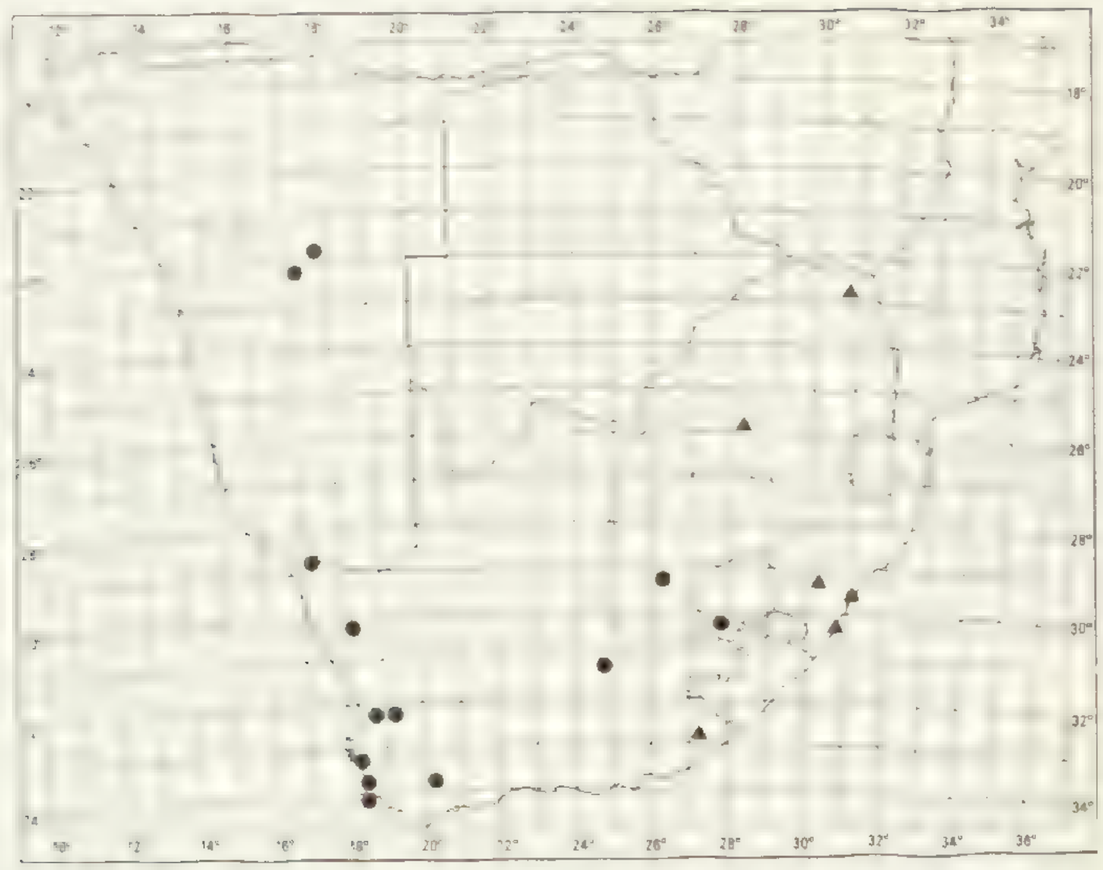
Autoicous. Perichaetia large, leaves distinct. *Capsule* immersed, gymnostomous, cupulate; operculum convex with short apiculus; calyptra small, campanulate; spores large.

A genus of 3 species, *Gigaspermum* is the most widely distributed genus in the family. The species found in southern Africa, *G. repens*, is also known from Australia and New Zealand.

Gigaspermum repens *(Hook.) Lindb.* in Öfvers. K. VetenskAkad. Förh. 21: 599 (1865); Broth. in Natürl. PflFam. 10: 316 (1924); Sim, Bryo. S. Afr. 289 (1926); Scott & Stone, Moss. S. Aust. 250 (1976). Type: Australia, *Menzies* s.n., 1791 (BM).

Anictangium repens Hook., Musci Exot. 2: 106 (1819). *Leptangium repens* (Hook.) Mitt. in J. Linn. Soc., Bot. 4: 79 (1859).

Physcomitrium breutelii C. Müll. in Bot. Ztg 13: 749 (1855). *Leptangium breutelii* (C. Müll.) Jaeg. in Verh. St. Gall. naturw. Ges. 1874–75: 155 (1876). *Gigaspermum breutelii* (C. Müll.) Par., Ind. Bryol. 511 (1896). Type:



MAP 111.— ● **Gigaspermum repens**
▲ **Oedipodiella australis**

Cape, Saldanha Bay, *Breutel* s.n. (BM, lecto.!), vide Fife in Bryologist 83: 476 (1981).

Plants small, light green to glaucous green, scattered or loosely caespitose; terricolous. *Branches* erect, 2−5 mm high, arising from a light yellow, highly branched, long-creeping, aphyllus rhizome; in section rhizome round, central strand absent, cortical cells in 4−5 rows, larger, thin-walled, outer row narrower, branches in section round, central strand indistinct, cells small, thin-walled, cortical cells in 3−4 rows, thin-walled. *Leaves* distant, erect-spreading, concave; orbicular-apiculate, 0,5−0,8 mm long; apiculus of several clear cells; margins plane, entire. *Costa* absent. *Laminal cells* angular, quadrate to subhexagonal, smooth; basal cells short-rectangular.

Autoicous. *Perigonia* axillary. *Perichaetia* terminal on erect branches, leaves highly differentiated; elliptical, long-acuminate, to 2,5 mm long; laminal cells rhomboidal to rectangular, hyaline. *Seta* very short, 0,3−0,5 mm long, yellowish; capsule immersed, gymnostomous, cupulate, 0,8−1,0 mm long, brownish yellow, mouth very broad; exothecial cells lax, quadrate to hexagonal, smaller in base, at mouth with single row of transversely rectangular cells; stomata present at base of urn, phaneropore; *peristome* absent; operculum plano-convex, apiculate, cells not twisted; calyptra small, campanulate; spores rounded to angular, 80−100 μm, reddish brown, finely granulate. Fig. 84.

FIG. 84.—**Gigaspermum repens: 1.** habit, × 1; **2.** habit, × 10; **3.** stem in cross section, × 175; **4.** leaves, × 40; **5.** leaf, × 120; **6.** leaf in cross section, × 175; **7.** perichaetial leaf, × 40; **8.** capsule and detached operculum, × 10. (1−8, *Garside* 6566).

Although *G. repens* is the most widely distributed species in the genus, the plants are rare in southern Africa. The plants form small patches among other mosses on dry, rocky soils in central South West Africa/Namibia, western and central Cape, Orange Free State and southern Lesotho. Map 111.

Vouchers: *Garside* 6566; *Magill* 4669; *Volk* 5253.

The scattered, sterile stems with minute, distant leaves are difficult to find; however the conspicuous perichaetial leaves and short, immersed, broad-mouthed capsules are very distinctive and will quickly identify the species.

2. CHAMAEBRYUM

Chamaebryum *Thér. & Dix.*, J. Bot., Lond. 60: 106 (1922); Broth. in Natürl. PflFam. 10: 315 (1924); Sim, Bryo. S. Afr. 289 (1926). Type species: *C. pottioides* Thér. & Dix.

Plants small, caespitose; terricolous. *Branches* erect, densely leaved, arising along a long, branched rhizome. *Leaves* crowded, broad, piliferous. *Costa* well developed, excurrent. *Laminal cells* small, thin-walled.

Monoicous. Perichaetia inconspicuous, leaves slightly larger. *Capsule* exserted, gymnostomous, mouth narrower than urn; spores large.

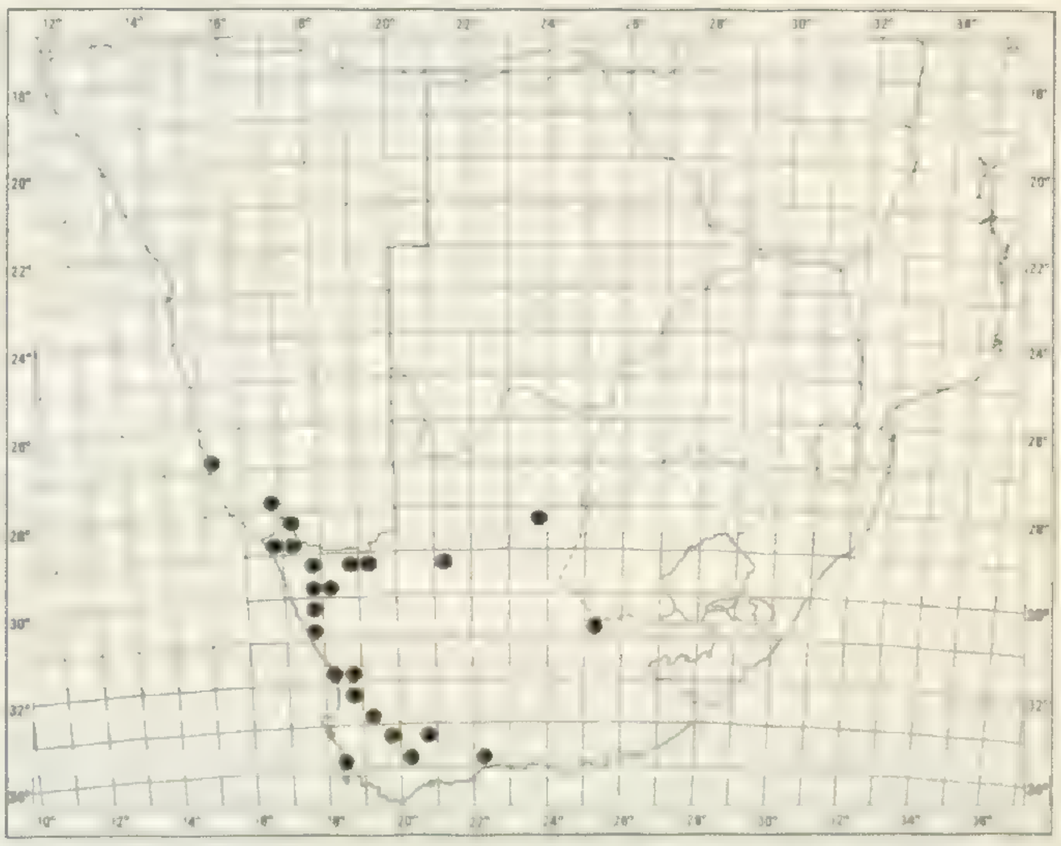
The monotypic genus *Chamaebryum*, is endemic to southern Africa.

Chamaebryum pottioides *Thér. & Dix.* in J. Bot., Lond. 60: 106 (1922); Sim, Bryo. S. Afr. 289 (1926). Lectotype: Cape, Cape Town, *Wager* 633 (BM, lecto.!; PRE!), vide Fife in Bryologist 83: 475 (1981).

Plants small, light green to grey-green, caespitose; terricolous. *Stems* erect, 2–6 mm high, arising from a brownish, highly branched, long-creeping rhizome; in section rhizome round, central strand absent, cortical cells in 6 rows, large, thin-walled, outer 2 rows smaller, brownish; branches in section round, central strand not well defined, of 8–10 smaller, thin-walled cells. *Leaves* crowded above, appressed dry, erect-spreading wet; obovate to orbicular, 0,8–1,2 mm long; apex obtuse, cuspidate to piliferous; base not differentiated; margins plane, entire. *Costa* percurrent in lower leaves, excurrent as short, hyaline awn in upper leaves, to 0,5 mm long; in section subround, bulging dorsally, cells in 3–4 rows, not strongly differentiated. *Laminal cells* subquadrate to angular, smooth; basal cells quadrate to very short-rectangular. *Gemmae* rare, produced at apex of sterile plants, bulging lenticular with a pronounced hyaline, distal apiculus, to 0,2 mm in diameter, cells ± hexagonal.

Monoicous. *Perigonia* terminal. *Perichaetia* terminal on erect branches; leaves slightly larger. *Seta* erect, 0,6–1,8 mm long, yellowish when wet, greyish when dry; capsule exserted, gymnostomous, short cylindrical, 1,0–1,3 mm long, bulging and reddish yellow when wet, irregularly striated to sulcate and greyish when dry, mouth narrow; exothecial cells lax, subhexagonal, 3–4 rows at mouth transversely rectangular; stomata present at base of urn, weakly cryptopore; *peristome* absent; operculum plano-convex with minute apiculus, remaining attached to columella when capsule first opens; calyptra not seen; spores rounded, 50–55 μm, reddish brown, granulate. Fig. 85: 1–8.

Endemic to southern Africa, *C. pottioides* is restricted to drier, rocky areas of southern South West Africa/Namibia and the western, central, northern and southern Cape. The species frequently forms large colonies in association with *Desmatodon*, *Goniomitrium*, *Ephemerum* and *Pleuridium*. Map 112.



MAP 112.— ● **Chamaebryum pottioides**

Vouchers: *Goldblatt* 2399*b*; *Lavranos* 15554*a*; *Magill & Schelpe* 3871, 4053; *Oliver, Tölken & Venter* 575; *Van Zanten* 7608360*a*.

The concave, piliferous leaves, rhizomatous habit and elevated, narrow-mouthed capsules will place this species. Young or sterile plants could be confused with *Goniomitrium* but it lacks a rhizome and the plants are dark green and scattered, with shorter seta and broad-mouthed capsules. Sterile colonies of *C. pottioides* have a greyish colouration when dry and are frequently quite compact.

3. OEDIPODIELLA

Oedipodiella *Dix.* in J. Bot., Lond. 60: 105 (1922); Broth. in Natürl. PflFam. 10: 315 (1924); Sim, Bryo. S.Afr. 288 (1926). Type species: *O. australis* (Wager & Dix.) Dix.

Plants medium-sized, dark green; terricolous. *Branches* erect, simple, scattered along leafless, branching rhizome. *Leaves* mostly obovate; apex rounded-apiculate; costa short-excurrent. *Laminal cells* small, quadrate to hexagonal. *Gemmae* produced at apex, lenticular.

Perichaetia terminal, leaves lingulate; costa ending below apex. *Capsules* subsessile, cleistocarpic, subglobose-rostrate; spores large.

The genus is known from southern Africa and Europe.

Oedipodiella australis *(Wager & Dix.) Dix.* in J. Bot., Lond. 60: 105 (1922); Sim, Bryo. S. Afr. 288 (1926). Syntypes: Natal, Umkomaas, *Wager* s.n.; Transvaal, Waterval, *Wager* s.n.; Pretoria, *Wager* s.n. (all PRE!).

Oedipodium australe Wager & Dix. in Trans. R. Soc. S. Afr. 4: 3 (1914).

Plants small to medium-sized, scattered or loosely caespitose, dark green; terricolous. *Branches* erect, 2–5 mm long, arising from a light yellow, branching, aphyllus rhizome; in section rhizome round, central strand absent, cortical cells in 5–6 rows, lax, thin-walled, outer 1–2 rows smaller; branches in section round, central strand not well defined, cortical cells in 4–5 rows, thin-walled. *Leaves* crowded above, weakly contorted when dry, widespreading when wet; obovate to spathulate or broadly elliptical, 2–4 mm long; apex rounded, abruptly apiculate; base oblong; margins plane, entire. *Costa* short-excurrent, ventral superficial cells smooth, dorsal superficial cells prorate; in section rounded, bulging dorsally, guide cells 2, small, ventral surface cells 2, small, dorsal substereid band very small, of 4–6 cells, dorsal surface cells larger, thin-walled. *Laminal cells* rounded, subquadrate to hexagonal, smooth; basal cells larger, short-rectangular. *Gemmae* produced at stem apex on sterile and fertile plants, lenticular, to 0,3–0,6 mm in diameter, cells quadrate to hexagonal or short-rectangular.

?Dioicous. Perichaetia terminal; leaves spathulate to lingulate, 3,0–3,5 mm long, apex rounded-apiculate; costa ending well below apex. *Seta* very short, 0,1 mm long; capsules immersed, cleistocarpic, subglobose, rostrate, urn horizontally depressed, 1,0 mm high by 1,5 mm wide, beak 0,5 mm long, erect to oblique; exothecial cells lax, quadrate to hexagonal; stomata present at base of urn; calyptra not seen; spores round, 45–50 μm, reddish brown, granulate. Fig. 85: 9–19.

Endemic to southern Africa, *O. australis* is found on soil in wooded kloofs and forests of the northern and central Transvaal, southern Natal, Transkei and the eastern Cape. Map 111.

Vouchers: *Bailey & Jacot Guillarmod* 75–105h (COLO); *Gordon-Gray* 5051; *Magill* 4977, 5003.

In general habit and colouration *O. australis* could be mistaken for species of *Hyophila* or *Weisiopsis;* however on closer examination the large, lens-shaped gemmae and branching rhizome will separate *Oedipodiella*. The small, immersed, horizontally depressed, subglobose capsules with long beaks are also very distinctive, but are rare and easily overlooked.

FIG. 85.—**Chamaebryum pottioides** (1–8): **1.** habit, × 1; **2.** habit, × 10; **3.** stem in cross section, × 87; **4.** leaves, × 40; **5.** leaf in cross section, × 175; **6.** basal leaf cells (left side), × 175; **7.** leaf apex showing upper laminal cells, × 175; **8.** portion of capsule mouth showing cells and spore, × 175. **Oedipodiella australis** (9–19): **9.** habit, × 1; **10.** habit, × 10; **11.** stem in cross section, × 87; **12.** leaves, × 40; **13.** leaf in cross section, × 175; **14.** basal leaf cells (left side), × 175; **15.** laminal cells at upper left margin, × 175; **16.** leaf apex, × 175; **17.** gemmae, side view, × 40; **18.** gemmae, face view, × 40; **19.** sporophyte, × 5. (1–8, *Oliver et al.* 77; 9–19, *Sim* PRE-CH9678).

EPHEMERACEAE

Plants minute, ephemeral, gregarious or scattered, frequently on persistent protonemal mat. *Stems* very short. *Leaves* few, larger above, spreading; linear-lanceolate to oblong-subulate; margins entire or serrate. *Costa* present or absent, sometimes weak below and strong above, percurrent to excurrent; in section cells not differentiated. *Laminal cells* rectangular to rhomboidal or fusiform, smooth or prorate.

Dioicous. *Seta* very short; capsules cleistocarpic, globose to ellipsoidal, short apiculate; calyptra cucullate, smooth or rough; spores large.

The family contains only two genera, *Ephemerum* and *Micromitrium*, only the former occurs in southern Africa. The genera are separated by the cleistocarpic capsules of *Ephemerum* and stegocarpic capsules of *Micromitrium*.

EPHEMERUM

Ephemerum *Hampe* in Flora, Jena 20: 285 (1837); Broth. in Natürl. PflFam. 10: 317 (1924); Sim, Bryo. S. Afr. 289 (1926); Grout, Moss Fl. N. Amer. 2: 67 (1935); Smith, Moss Fl. Brit. Irel. 346 (1978). Lectotype species: *E. serratum* (Hedw.) Hampe, fide Grout, Moss Fl. N. Amer. 2: 67 (1935).

With characters of family.

The genus consists of c. 28 species. The species are found in most areas of the world, but are most common in temperate regions. Concentrations of species occur in North America, Europe, North Africa, eastern South America, southern Africa and Australia.

Both *E. sessile* and *E. serratum* are excluded from the Flora. None of the southern African species have spores that even approach the size given for *E. sessile*, i.e. 60–80 μm, or most of the Northern Hemisphere species. The southern African species have weakly ornate spores that range between 25–40 μm in diameter.

The specimen Sim (1926) put into *E. serratum* is *E. capense*. Although the two species are similar, the latter has much smaller leaves that barely reach the mid-point of the capsule, in addition to its smaller spores.

1 Leaves very small, to 0,5 mm long; margins spinose; costa absent ..... 1. *E. capense*
1 Leaves larger, 1–2 mm long; margins entire to serrate; costa present, occasionally obsolete:
  2 Leaf margins serrate to coarsely serrate; cells in upper leaf prorate; calyptra rough ..... 2. *E. namaquense*
  2 Leaf margins entire to serrulate; laminal cells smooth, calyptra smooth:
    3 Leaf margins entire to serrulate, occasionally with a few teeth at apex; perichaetial leaves not distinct, costa well defined ..... 3. *E. rehmannii*
    3 Leaf margins entire; perichaetial leaves distinct, costa very weak to absent ..... 4. *E. diversifolium*

1. **Ephemerum capense** *C. Müll.* in Flora, Jena 71: 12 (1888); Broth. in Natürl. PflFam. 10: 318 (1924). Type: Cape, Somerset East, Mt Boschberg, *MacOwan* s.n., 1882.

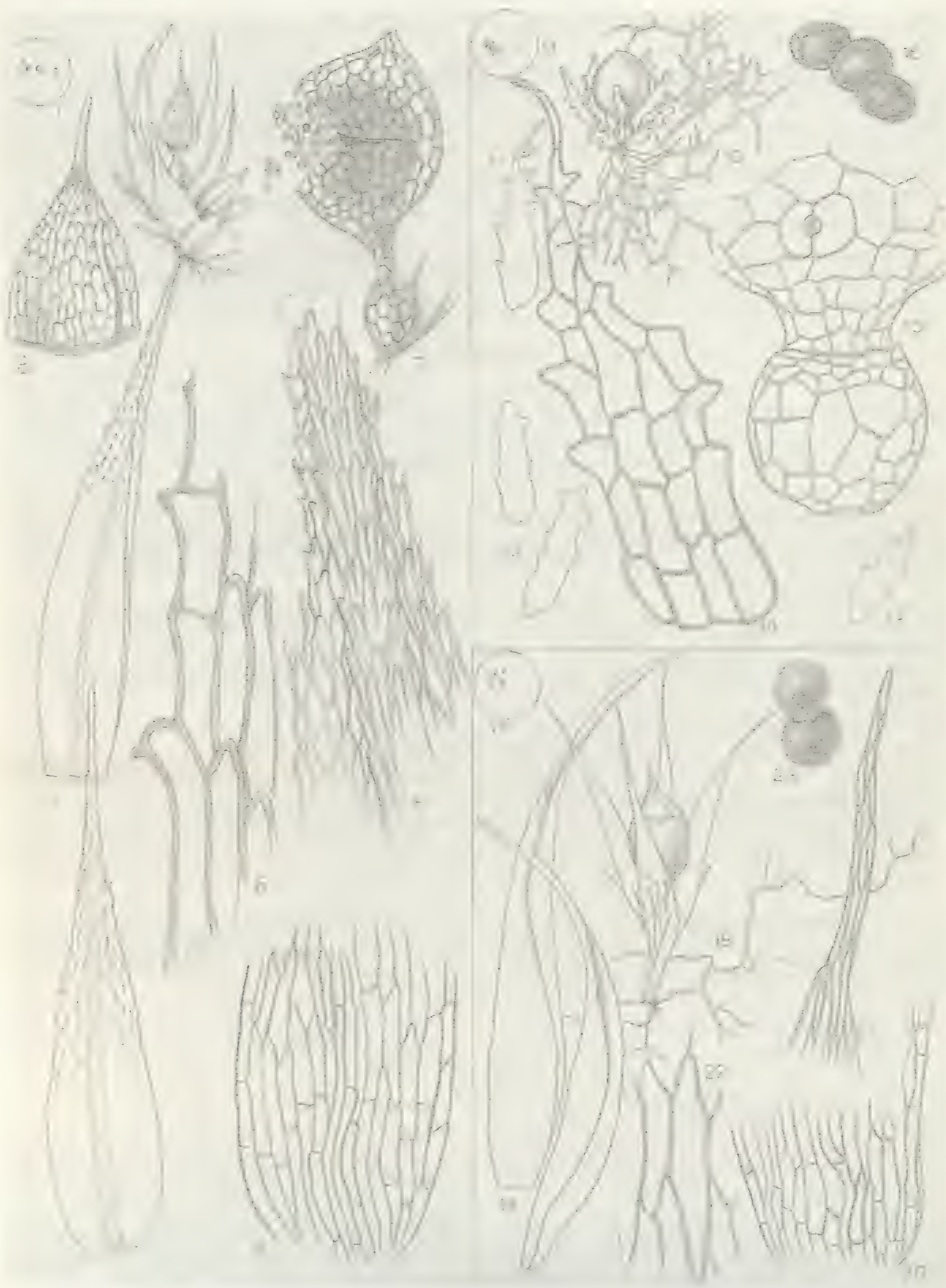
Plants minute, acaulescent, scattered on persistent protonema, light green; terricolous. *Leaves* few, 1–5 at base of vaginula, widespreading; linear to elliptical, 0,2–0,4 mm long, only a few cells wide; apex acute to acuminate; margins plane, spinose. *Costa* absent. *Laminal cells* rectangular to rhomboidal, 2–6: 1, smooth; basal cells rectangular.

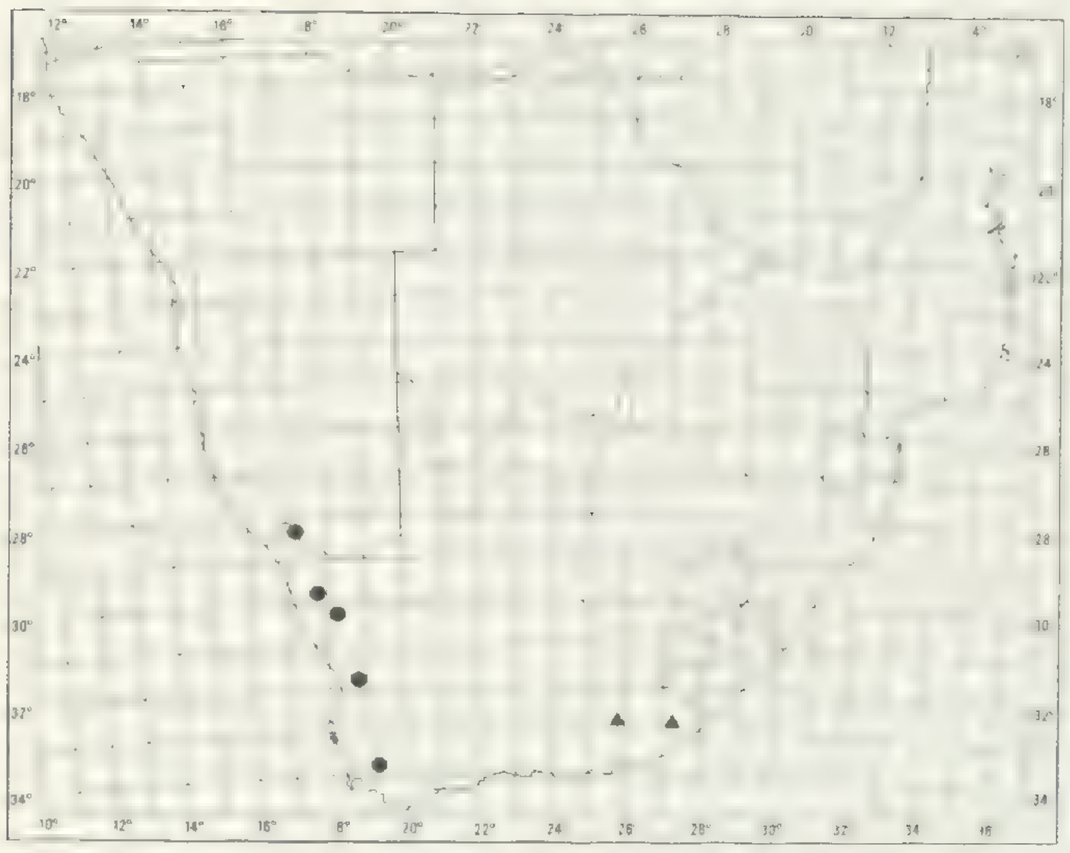
Capsules ± sessile, cleistocarpic, orbicular, 0,3 mm long, reddish yellow, vaginula globose, 0,1 mm long; exothecial cells quadrate to short-rectangular; stomata few, present at base of urn, phaneropore; calyptra cucullate, 0,2 mm long, smooth; spores subround, 37–40 μm, yellowish brown, sharply papillose. Fig. 86: 9–16.

Endemic to southern Africa, *E. capense* is presently known only from the shrublands of the central and eastern Cape. Map 113.

Voucher: *Sim* 7094.

This species was treated by Sim (1926) as *E. serratum*, but the plants are considerably smaller than that species in all respects. The leaves of *E. capense* are very short and just reach the mid-point of the capsule. They are rarely visible when the capsules are mature, giving an impression of naked capsules scattered on the dense persistent protonema. The spores are the largest (37–40 μm) of any southern African species of *Ephemerum*, but they are still smaller than the range reported for *E. serratum* (40–70 μm).





MAP 113.— ● **Ephemerum namaquense**
▲ **Ephemerum capense**

2. **Ephemerum namaquense** *Magill*, sp. nov., E. crassinervio *(Schwaegr.) Hampe similis, sed marginibus foliorum valde serratis, stomatibus limitatis ad basim thecarum et sporis minoribus*.

Type: Cape, Namaqualand, along road to Niewoudtville, 10 km NE of Vanrhynsdorp, on clay near road, sandy flats with dwarf succulent shrubs, *Magill & Schelpe* 3921 (MO, holo.; PRE; BOL).

Plants minute, scattered or gregarious, light green to yellow-green; terricolous. *Stems* to 0,5 mm long. *Leaves* larger above, erect-spreading; lanceolate to linear-lanceolate, 0,7−1,3 mm long; margins plane, serrulate to coarsely serrate above. *Costa* percurrent to just excurrent, distinct in leaf base; in section round, 4−5 cells thick, cells undifferentiated, incrassate, round, surface cells bulging outward. *Laminal cells* rectangular to rhomboidal, 4−6: 1, prorate above mid-leaf; basal cells rectangular, smooth.

Dioicous. Androgametophyte small, leaves ovate, margins serrate. Perichaetia terminal, leaves larger, subulate. *Seta* 0,1−0,2 mm long, yellowish; vaginula elliptical 0,2 mm long, reddish yellow; capsule globose to short-elliptical, short-rostrate, 0,3−0,5 mm long, yellowish, beak to 50 μm long; exothecial cells quadrate to rectangular, or some subhexagonal; stomata restricted to extreme base, phaneropore, reddish; calyptra large, cucullate, 0,2−0,3 mm long, rough by prorate cells; spores immature, round, 33 μm, yellowish, weakly granulate. Fig. 86: 1−8.

Endemic to southern Africa, *E. namaquense* is found in small patches on soil among other mosses in shrublands of the western Cape. Map 113.

Vouchers: *Magill & Schelpe* 3909; *Oliver* 7223; *Schelpe* 4915a.

This species is closely related to *E. crassinervium* (Schwaegr.) Hampe through the prorate leaf cells and rough calyptra but differs in more coarsely serrate leaf margins; stomata restricted to extreme base of capsule, and smaller, less ornate spores.

3. **Ephemerum rehmannii** *(C. Müll.) Broth.* in Natürl. PflFam. 10: 319 (1924); Sim, Bryo. S. Afr. 291 (1926). Type: Orange Free State, Bloemfontein, *Rehmann* s.n., 1875 (G!).

Ephemerella rehmannii C. Müll. in Flora, Jena 71: 12 (1888).

Ephemerella nervosa Dix. in Trans. R. Soc. S. Afr. 18: 254 (1930). *Ephemerum nervosa* (Dix.) Schelpe in Mem. bot. Surv. S. Afr. 43: 7 (1979). Type: Cape, King William's Town, *Wager* 809 (BM; PRE!).

Plants minute, scattered or in small groups, light green to yellow-green; terricolous. *Stems* 0,5 mm long; in section round, central strand absent, cortical cells large, thin-walled. *Leaves* larger above, weakly secund dry, erect wet; lanceolate, acuminate to subulate, 1,0−2,5 mm long; margins weakly incurved, entire to serrulate or occasionally with a few teeth at apex. *Costa* long- to short-excurrent, awn flexuose, smooth or with a few small serrations, weaker in leaf base; in section round, 3−4 cells thick, cells round, incrassate, not differentiated or internal cells more strongly thickened. *Laminal cells* rectangular to oblong-rhomboidal or fusiform, to 10: 1; basal cells rectangular.

Perichaetial leaves longer, shape similar. *Seta* very short, yellowish; vaginula cylindrical, 0,2 mm long; capsule ellipsoidal, short apiculate, 0,5−0,8 mm long, yellowish to brownish-

FIG. 86.—**Ephemerum namaquense** (1−8): **1.** habit, × 1; **2.** habit (sporophyte immature), × 35; **3.** leaves, × 70; **4.** leaf base, × 175; **5.** cells at upper leaf, dorsal surface, × 175; **6.** laminal cells at upper margin, × 700; **7.** sporophyte, ruptured to show spores, × 70; **8.** calyptra, × 70. **E. capense** (9−16): **9.** habit, × 1; **10.** habit, × 50; **11−13.** leaves, × 70; **14.** leaf, × 350; **15.** vaginula and lower sporophyte showing stomata, × 350; **16.** spores, × 350. **E. rehmannii** (17−23): **17.** habit, × 1; **18.** habit, × 12; **19.** leaves, × 35; **20.** leaf base, × 175; **21.** leaf apex, × 175; **22.** median leaf cells, × 500; **23.** spores, × 350. (1−8, *Oliver* PRE-CH12902; 9−16, *Sim* 7094; 17−23, *Rehmann* s.n., 1875).

MAP 114.— ● **Ephemerum rehmannii**
▲ **Ephemerum diversifolium**

yellow; exothecial cells rectangular, thin-walled; stomata present at base of urn, phanerostome; calyptra cucullate, 0,3−0,4 mm long, smooth; spores subround, 25−35 μm, reddish brown, papillose to sharply papillose. Fig. 86: 17−23.

Endemic to southern Africa, *E. rehmannii* is found in the dry shrublands or grasslands of Zululand, Orange Free State and the southern, eastern and western Cape. Map 114.

Vouchers: *Schelpe* 7625; *Sim* 7097; *Wager* 1459.

Most of the southern African specimens referred to *E. sessile* belong here. *Ephemerum rehmannii* can be most easily separated from *E. sessile* by its spores only half as large, leaves frequently toothed above and the excurrent costa that forms a generally smooth, flexuose awn.

An unusual form of this species collected in Bain's Kloof (*Schelpe* 6369) is more similar to *E. sessile* through its lanceolate-subulate leaves that reach a length of 2,5 mm. The spores are only 35 μm in diameter however, not reaching the 60−80 μm reported for *E. sessile*.

4. **Ephemerum diversifolium** *Mitt.* in Harvey, Thes. Cap. 1: 63 (1859); Sim, Bryo. S. Afr. 291 (1926). Type: Cape, Uitenhage, Zwartkop's River, *Zeyher* s.n. (NY, holo.!).

Plants minute, scattered on persistent protonema, light green to yellow-green; terricolous. *Stems* to 0,1 mm long. *Leaves* larger

FIG. 87.—**Ephemerum diversifolium: 1.** habit, × 1; **2.** habit, × 35; **3.** leaf, × 70; **4.** leaf in cross section, × 350; **5.** leaf base, × 175; **6.** leaf apex, × 175; **7.** median leaf cells, × 700; **8.** sporophyte with calyptra and perichaetial leaf, × 70; **9.** portion of capsule base showing stomata and spores, × 175; **10.** spores, × 350. (1−10, *Harvey* s.n.)

above, weakly twisted dry, erect-spreading wet; elliptical, acuminate to subulate, 0,8–1,2 mm long; margins plane, entire. *Costa* excurrent to long-excurrent, to 0,4 mm long, distinct in leaf base; in section bulging dorsally, to 4 cells thick, internal cells undifferentiated, surface cells slightly smaller than laminal cells, incrassate. *Laminal cells* oblong-rhomboidal to fusiform, 8: 1, smooth; basal cells rectangular.

Dioicous. Androgametophytes small, gemmate, 0,25 mm tall. Perichaetia terminal, leaves narrow-elliptical to ligulate, 1,3 mm long; costa very weak or absent in inner leaves; cells irregularly fusiform. *Seta* very short, 0,05 mm long, yellowish; vaginula narrow, 0,15 mm long; capsule ovate-apiculate, 0,7–1,0 mm long; exothecial cells rectangular to rhomboidal, but with areas of shorter cells; stomata present at extreme base of urn, phaneropore; calyptra cucullate, 0,4 mm long, smooth; spores subround, 25–30 μm, brownish yellow, granulate. Fig. 87.

A very distinct species known only from the type locality in the shrublands of the southern Cape. Map 114.

Voucher: Type only.

The small plants are almost buried in the copious mass of protonema which frequently sends up larger filaments (stolons of Mitten) that are profusely branched at the tip. The plants are probably most distinctive because of their highly differentiated perichaetial leaves. When examined in Hoyer's solution, the narrowly elliptical to ligulate leaves show the costa to be obsolete to absent. The costa in the vegetative leaves is excurrent, frequently to a length of 0,4 mm and quite distinct throughout the leaf.

Insufficiently Known Species

Ephemerum piliferum Shaw in Cape Monthly Mag. 17: 314 (1878). Type: Cape, Oudeberg, Graaff-Reinet, *MacLea* s.n., 1872. As suggested by Sim (1926) the description is not adequate to place the species and type material has not been located.

FUNARIACEAE

Plants annual or biennial, small to medium-sized, generally light green; terricolous. *Stems* erect, simple; central strand generally present. *Leaves* more or less lax, mostly crowded above, erect, broad and concave; margins plane to broadly incurved, entire or often serrate, rarely bordered. *Costa* strong, percurrent to excurrent; in section rounded, bulging dorsally. *Laminal cells* large, wide, smooth, rectangular to truncate-rhomboidal or occasionally hexagonal, thin-walled; marginal cells generally narrower, rarely forming a distinct border; basal cells generally larger, rectangular.

Monoicous or rarely dioicous. Perichaetia terminal, leaves not strongly differentiated. *Capsules* immersed or long exserted, stegocarpic or occasionally cleistocarpic, erect to cernuous or pendent; globose to pyriform, symmetric or curved, frequently with well defined neck; annulus present, usually well developed, occasionally revoluble; *peristome* absent, single or double, teeth 16, strongly trabeculate, segments opposite teeth, cilia absent; operculum plano-convex to conic, often apiculate; calyptra smooth, generally cucullate-inflated and rostrate or smaller, mitrate; spores small, granulate.

The family Funariaceae consists of 16 genera, some large and very widespread in distribution (*Funaria, Physcomitrium*), but most very small and quite restricted. The six genera present in southern Africa exhibit the full range of capsule morphology expressed by the family; i.e. cleistocarpic or stegocarpic and gymnostomous to peristomate. The peristomate capsules also exhibit a complete gradation in peristome development, from rudimentary to well developed, single or double.

The broad, concave leaves with large, lax leaf cells, generally with flattened ends, should place most sterile specimens. The capsules are very distinctive and will easily identify the family and genera. Some southern African taxa of Bryaceae bear a slight macroscopic resemblance to *Funaria*. The former are easily separated by peristome morphology, and their upper laminal cells being evenly rhomboidal with pointed ends.

1 Plants small, stems very short; capsules immersed to emergent:
- 2 Capsule stegocarpic, mouth broad:
  - 3 Upper leaves broadly obovate, margins entire; calyptra large, 8-plicate ..... 1. **Goniomitrium**
  - 3 Upper leaves narrowly spathulate, margins strongly serrate; calyptra small, smooth:
    - 4 Capsules immersed, small, hemispherical, 0,5–0,6 mm long; spores papillose; growing on alluvial mud and river banks in Zululand ..... 2. **Micropoma**
    - 4 Capsules immersed to emergent, cupulate, 1,0–1,5 mm long; spores spinose; growing on soil in semi-arid shrublands of the eastern Cape ..... 5. **Physcomitrium**
- 2 Capsule cleistocarpic; calyptra minute, smooth:
  - 5 Plants bulbiform; perichaetial leaves large, strongly concave, completely enclosing sporophyte; capsule pyriform, pendent ..... 3. **Cygnicollum**
  - 5 Plants with erect to spreading leaves; perichaetial leaves spreading, exposing sporophyte; capsule elliptical, erect ..... 4. **Physcomitrellopsis**

1 Plants larger, stems elongated; capsule exserted on long seta:
- 6 Capsules cupulate, neck very short; exothecial cells quadrate to hexagonal; leaves with distinct border of narrower, thin-walled cells ..... 5. **Physcomitrium**
- 6 Capsules cylindrical to pyriform, neck long; exothecial cells rectangular; leaves without distinct border or if present marginal cells incrassate ..... 6. **Funaria**

1. GONIOMITRIUM

Goniomitrium *Wils.* in Hooker, J. Bot., Lond. 5: 142 (1846); Broth. in Natürl. PflFam. 10: 324 (1924); Sim, Bryo. S. Afr. 292 (1926); Stone in J. Bryol. 11: 491 (1981). Type species: not designated.

Rehmanniella C. Müll. in Bot. Zbl. 7: 347 (1881). Type species: *R. africana* C. Müll.

Plants small, gregarious; terricolous. *Stems* short, simple; central strand present. *Leaves* spreading wet, obovate-cuspidate; margins plane, entire. *Costa* short-excurrent. *Laminal cells* hexagonal to rhomboidal, thin-walled.

Paroicous or dioicous. *Seta* short; capsule emergent, stegocarpic, gymnostomous, cupulate with broad mouth; operculum plano-convex, apiculate; calyptra mitrate, 8-plicate; spores large.

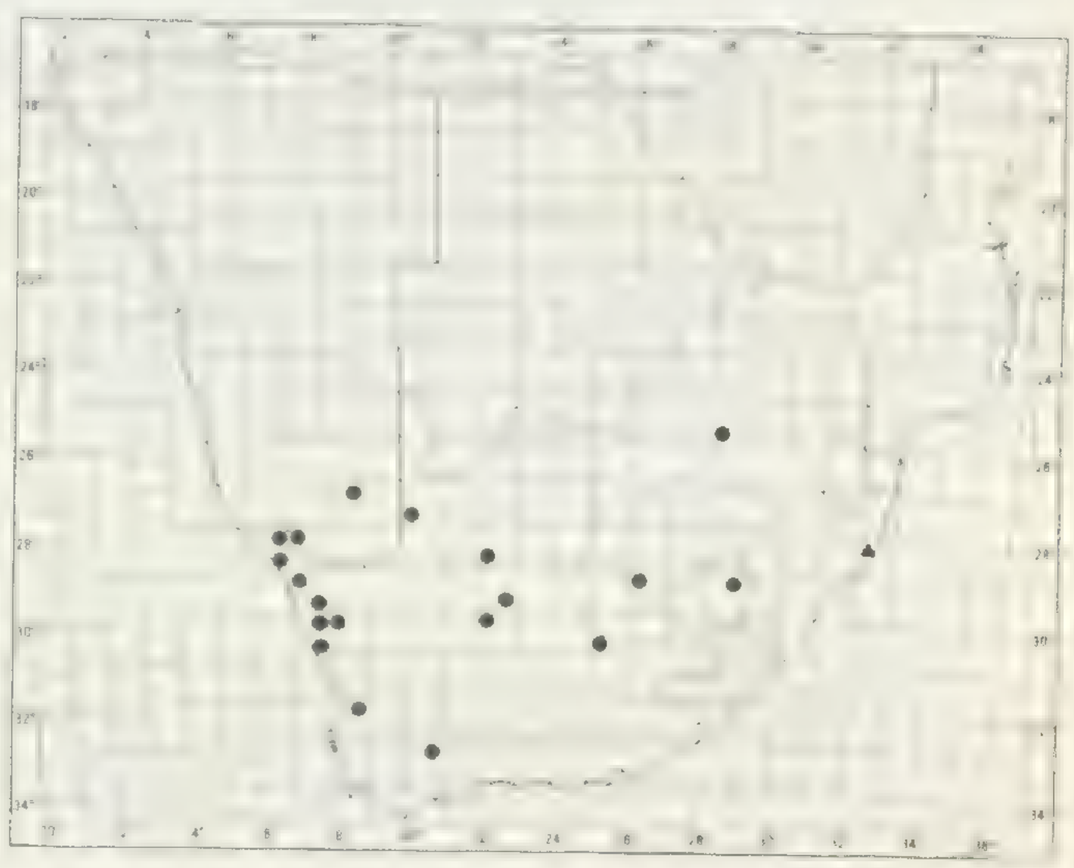
The four species of *Goniomitrium* are equally divided between Africa and Australia. Each of the species is restricted in its distribution and distinctive morphologically.

Goniomitrium africanum *(C. Müll.) Broth.* in Natürl PflFam. 1: 521 (1903); Sim, Bryo. S. Afr. 292 (1926). Type: Orange Free State, near Bloemfontein, *Rehmann* 171 (NH!).

Rehmanniella africana C. Müll. in Bot. Zbl. 7: 347 (1881).

Plants small, scattered or gregarious, dark green; terricolous. *Stems* 1–2 mm high, simple, radiculose below; in section round, central strand weak, cells thin-walled, inner cortical cells in 2–4 rows, outer cortical cells in 2 rows, smaller, reddish brown. *Leaves* crowded and larger above, infolded and appressed dry, erect-spreading wet; broadly elliptical to obovate or subspathulate, 1,5–2,5 mm long; apex apiculate to cuspidate; base oblong; margins plane, entire. *Costa* short-excurrent; in section subround, lamina attached ventrally, guide cells 2, exposed ventrally, dorsal stereid band weak, 2 cells thick, occasionally substereids, dorsal surface cells generally strongly thickened, smaller than guide cells. *Upper laminal cells* hexagonal to rhomboidal or subrectangular, thin-walled; marginally quadrate to rectangular; basal cells quadrate.

Paroicous. Perichaetial leaves slightly larger, not distinct. *Seta* variable in length, 0,5–2,0 mm long; capsule emergent to exserted, erect, stegocarpic, cupulate, with broad mouth, 1 mm long, irregularly sulcate when dry, reddish yellow; exothecial cells quadrate to rectangular or angular, thin-walled, with 1–2 rows of quadrate cells at mouth and 5–6 rows of transversely rectangular cells just below; stomata present at base of urn, phaneropore; *peristome* absent; operculum plano-convex, 0,7–0,8 mm in diameter, cells not twisted; calyptra mitrate, 1,5 mm long, smooth but 8-sided because of longitudinal plications; spores



MAP 115.— ● **Goniomitrium africanum**
▲ **Micropoma niloticum**

rounded, 50–75 μm, yellowish, granulate with a weak reticulate pattern. Fig. 88: 1–10.

Endemic to southern Africa, *G. africanum* occurs on open soil, in dry rocky regions of southern South West Africa/Namibia, the western, northern and central Cape Province, and infrequently in the Orange Free State, Lesotho and central Transvaal. The species forms large patches after the winter rains, but is only infrequently collected. Map 115.

Vouchers: *Magill & Schelpe* 3834a, 4038; *Oliver* 6299, 7255; *Smook & Harding* 695; *Volk* 5298.

When sporophytes are present the large-mouthed capsule and spreading, dark green, cuspidate leaves will place the species. The large, unusual, 8-sided, plicate calyptra is also very distinctive.

The seta length in different specimens is quite variable. A recent study indicated that the variation was not significant and found no supporting characters on the specimens with long setae (Schelpe, pers. comm.).

In his recent generic revision of Funariaceae, Fife (1985) reduced *G. africanum* to a subspecies of *G. acuminatum* Hook. & Wils., an Australian species.

FIG. 88.—**Goniomitrium africanum** (1–10): **1.** habit, × 1; **2.** habit, × 10; **3.** plants, × 2; **4.** stem in cross section, × 200; **5.** leaves, × 40; **6.** leaf in cross section, × 175; **7.** basal leaf cells (right side), × 175; **8.** leaf apex, × 175; **9.** sporophyte, × 10; **10.** calyptra, × 10. **Micropoma niloticum** (11–19): **11.** habit, × 1; **12.** habit, × 10; **13.** stem in cross section, × 200; **14.** leaves, × 40; **15.** leaf in cross section, × 350; **16.** basal leaf cells (left side), × 175; **17.** leaf apex, × 175; **18.** sporophyte, operculum detached, × 20; **19.** spores, × 560. (1–10, *Oliver* 6299; 11–19, *Junod* 323).

2. MICROPOMA

Micropoma *Lindb.* in Notis. Saellsk. F. Fl. Fenn. Foerh. 11: 56 (1871); Broth. in Natürl. PflFam. 10: 322 (1924); Sim, Bryo. S. Afr. 291 (1926). Type species: *M. niloticum* (Delile) Lindb.

Plants small, gregarious; terricolous. *Stems* short, simple; central strand present. *Leaves* narrow, spathulate; margins serrate. *Costa* percurrent to subpercurrent. *Laminal cells* lax, rhomboidal to rectangular.

Autoicous. *Seta* short; capsule immersed, stegocarpic, hemispherical with very broad mouth, gymnostomous; operculum convex-apiculate; calyptra mitrate, smooth; spores large.

The genus contains two species, *M. niloticum* from southern and eastern Africa as well as the Middle East, and *M. bukobense* from central Africa. Both species were recently placed in *Physcomitrium* subgen. *Cryptopyxis* by Fife (1982).

Micropoma niloticum *(Delile) Lindb.* in Broth. in Natürl. PflFam. 1: 518 (1903); 10: 322 (1924); Sim, Bryo. S. Afr. 292 (1926); El-Saadawy in Proc. Egypt. Acad. Sci. 25: 217 (1972). Type: Egypt, *Delile* s.n.

Gymnostomum niloticum Delile, Fl. Aegypt. 2: 43 (1813). *Physcomitrium niloticum* (Delile) C. Müll. in Bot. Ztg 16: 154 (1858).

Plants small, scattered, gregarious, light green, ± shiny; terricolous. *Stems* (0,5−)2−3 mm long, occasionally elongated with a few branches; in section round, central strand collapsed, dark brown, cortical cells in 3−4 rows, little differentiated or outer row ± larger. *Leaves* weakly contorted dry, spreading wet; narrowly spathulate, 1−2(−3) mm long, apex abruptly acuminate; base oblong; margins plane, strongly serrate above base by projecting cell ends. *Costa* weak, ending below apex or extending into acumen; in section bulging dorsally, guide cells 2, ventral cells 2, in single layer, similar to guide cells, dorsal stereid band small, consisting of 2−4 cells, dorsal surface cells smaller than guide cells, thickened. *Laminal cells* lax, rectangular to rhomboidal, mostly 2−3: 1; basal cells rectangular, thin-walled.

Perichaetial leaves slightly larger, not distinct. *Seta* erect, 0,4−0,6 mm long, yellowish to yellow-brown; capsule immersed, urn hemispherical, 0,5−0,6 mm long, smooth, yellow-brown, neck absent; exothecial cells lax, transversely rectangular to rhomboidal, 4 rows at mouth abruptly narrower and transversely rectangular; stomata present at extreme base of urn, phaneropore; annulus absent; peristome absent; operculum convex-apiculate, cells not twisted; spores subround to angular, 30−37 μm, light brown, papillose to strongly papillose. Fig. 88: 11−19.

The species grows on alluvial mud and river banks in the Gaza Strip, Egypt, Zimbabwe, Mozambique and South Africa. Although *M. niloticum* has been known from Maputo for some time (Sim, 1926), it has only recently been discovered in Zululand, mixed with *Ephemerum rehmannii*. Map 115.

Voucher: *Taylor* 478.

The species is most easily recognized by its narrow-spathulate leaves and very broad-mouthed, immersed, hemispherical capsules. Sterile stems are frequently elongated with distant leaves.

3. CYGNICOLLUM

Cygnicollum *Fife & Magill* in Bryologist 85: 99 (1982). Type species: *C. immersum* Fife & Magill.

Plants very small, bulbiform, light green; terricolous. *Stems* simple, central strand present. *Leaves* obovate-acuminate, concave; margins crenulate above. *Costa* subpercurrent to short-excurrent. *Upper laminal cells* rhomboidal to oblong-rhomboidal, thin-walled; marginal cells narrower.

Perichaetia terminal, leaves large, conspicuous, strongly concave, enclosing sporophyte. *Seta* short, erect; capsule cleistocarpic, pyriform, pendent, neck cygneous; calyptra small, campanulate; spores irregularly papillose.

A very distinct genus recognized by the bulbiform habit and completely enclosed, pendent, cleistocarpic capsules. The taxon seems, through most of its characters, properly placed in Funariaceae. However, it does not appear to be closely related to any of the other genera of the family.

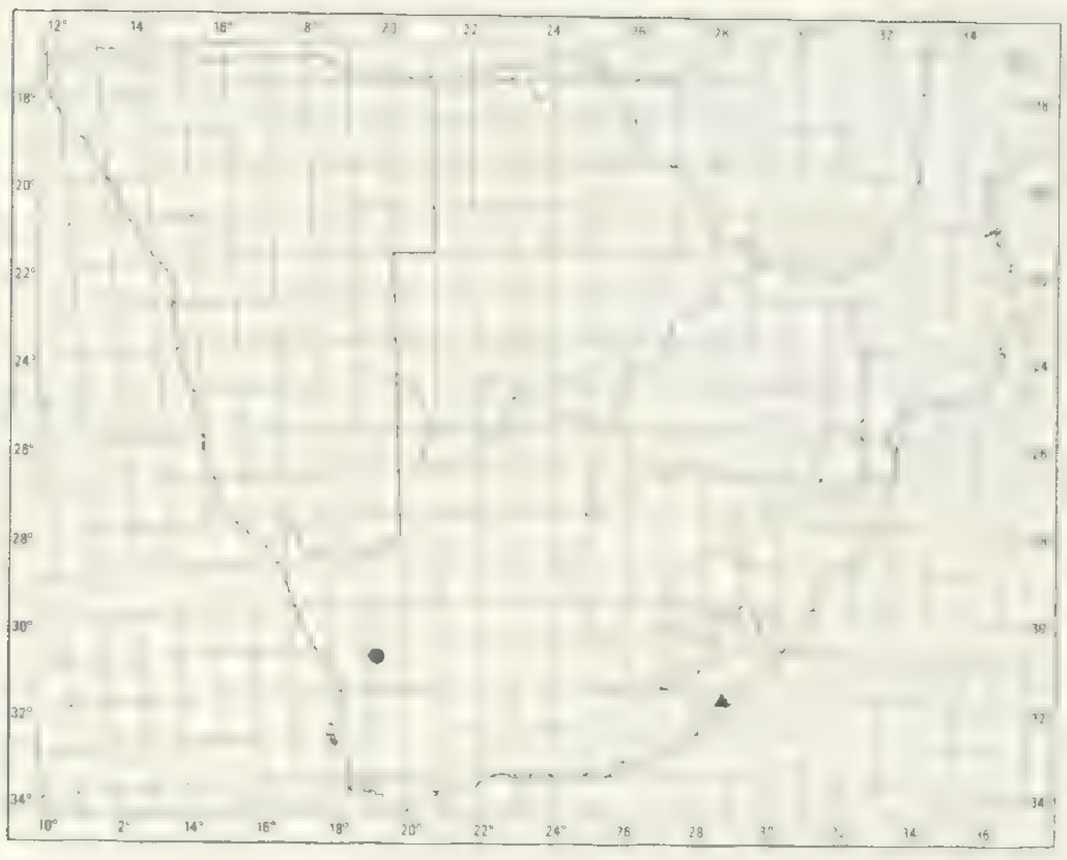
Cygnicollum immersum *Fife & Magill* in Bryologist 85: 99 (1982). Type: Cape, upper slopes of Vanrhyns Pass, 40 km NE of Vanrhynsdorp along road to Nieuwoudtville, *Magill & Schelpe* 3952 (PRE, holo.; BUF; MICH; MO).

Plants minute to small, bulbiform, solitary, light green; terricolous. *Stems* to 1 mm high, simple; in section round, central strand small, inner cortical cells in 2 rows, large, thin-walled, outer cortical cells in single row, small, incrassate, reddish brown, epidermal cells larger, thin-walled. *Leaves* larger above, erect-spreading wet, little altered dry, lower leaves obovate-apiculate, to 1,5 mm long; upper leaves oblong-obovate, acuminate, 1,5−3,0 mm long; margins plane, entire below, bluntly serrate above. *Costa* ending below apex in lower leaves to short-excurrent in upper leaves; in section rounded, with a large central stereid band 2−4 cells thick and enclosing 1−2 larger, irregular cells or gaps, ventral cells in single row, large, firm-walled, dorsal surface cells similar to ventral cells, thickened. *Upper laminal cells* rhomboidal to oblong-rhomboidal, thin-walled; upper marginal cells narrower, long-rectangular, but not forming distinct border, upper ends projecting as marginal teeth; basal cells lax, rectangular.

Autoicous. Perigonial branch short, at base of main stem, gemmate. Perichaetia terminal, leaves large, conspicuous, strongly concave, completely enclosing capsule. *Seta* short, erect, 0,7−1,0 mm long , yellowish; capsule broadly pyriform, cleistocarpic, pendent because of cygneous neck, 1,0−1,3 mm long, yellowish brown; exothecial cells quadrate to rectangular or occasionally rhomboidal, thin-walled; stomata present on neck, phaneropore; calyptra small, narrowly campanulate, 0,6 mm long, smooth; spores subreniform, 25 −35 μm, yellowish, irregularly papillose. Fig. 89.

Known only from soil in small open areas in shrublands of the upper Vanrhyn's Pass. The specimens were collected on the south face of the escarpment at c. 800 m.

FIG. 89.—**Cygnicollum immersum: 1.** habit, × 1; **2.** habit, × 10; **3.** leaf, × 35; **4.** leaf in cross section, × 350; **5.** basal leaf cells (right side), × 175; **6.** laminal cells at upper left margin, × 350; **7.** apical leaf cells, × 175; **8.** sporophyte, × 35; **9.** calyptra, × 35; **10.** stomatal apparatus, × 700; **11.** spore, × 500. (1−11, *Magill & Schelpe* 3952).



MAP 116.— ● **Cygnicollum immersum**
▲ **Physcomitrellopsis africana**

The collection site in the north western Cape receives a high rainfall for this region. Map 116.

Voucher: *Magill & Schelpe* 3937.

The completely enclosed sporophyte is very unique. The seta is short and erect but the neck of the pyriform capsule is cygneous resulting in a pendent urn.

The cleistocarpic capsules and large, papillose spores are known in Funariaceae, however the calyptra of *Cygnicollum* is rather small for the family. Leaf shape and areolation also confirm placement in Funariaceae.

4. PHYSCOMITRELLOPSIS

Physcomitrellopsis *Broth. & Wager* ex *Dix.* in J. Bot., Lond. 60: 107 (1922); Broth. in Natürl. PflFam. 10: 321 (1924); Sim, Bryo. S. Afr. 291 (1926). Type species: *P. africana* Wager & Broth.

Plants small, gregarious, green; terricolous. *Stems* erect, unbranched; central strand present. *Leaves* spreading wet; spathulate-acuminate; margins plane, entire. *Costa* ending below apex. *Laminal cells* rectangular, becoming rhomboidal above, smooth.

Perichaetia terminal, leaves larger, otherwise little differentiated. *Capsule* exposed, subsessile, erect, cleistocarpic; calyptra large, enclosing capsule, mitrate-rostrate; spores weakly papillose.

Endemic to southern Africa, *Physcomitrellopsis* presently contains a single species found in the southeastern part of the Flora area. The only other species described in the genus, *Physcomitrellopsis indica* Dix., was recently transferred to *Physcomitrium* by Gangulee (1974).

Physcomitrellopsis africana *Wager & Broth.* ex *Dix.* in J. Bot., Lond. 60: 107 (1922); Sim, Bryo. S. Afr. 291 (1926). Type: Natal, *Wager* s.n. (H, holo.; BM).

Plants small, gregarious, green; terricolous. *Stems* 1,0−1,5 mm high, simple; in section round, central strand small, inner cortical cells in 2−4 rows, thin-walled, outer cortical cells in 2−3 rows, slightly thickened. *Leaves* crowded above, weakly contorted dry, spreading wet; spathulate-acuminate, 4−5 mm long; base oblong; margins plane, entire below, strongly dentate above base. *Costa* subpercurrent; in section subrounded, guide cells 2−3, small, ventral cells in single row, similar to guide cells, dorsal stereid band small, group of 6−8 cells, frequently with gap below guide cells, dorsal surface cells ± larger, thin-walled. *Laminal cells* rectangular to oblong-rhomboidal; upper marginal cells bulging; basal cells rectangular.

Autoicous. Perichaetia terminal, leaves large, spathulate-acuminate, widespreading

FIG. 90.—**Physcomitrellopsis africana** (1−10): **1.** habit, × 1; **2.** habit, × 10; **3.** portion of stem in cross section, × 140; **4.** leaf, × 35; **5.** leaf in cross section, × 350; **6.** basal leaf cells at right margin, × 175; **7.** median leaf cells, × 175; **8.** laminal cells at upper right margin, × 175; **9.** leaf apex, × 175; **10.** spore, × 500. **Physcomitrium spathulatum** (11−21): **11.** habit, × 1; **12.** habit (var. **spathulatum**), × 10; **13.** habit (var. **sessile**), × 10; **14.** stem in cross section, × 140; **15.** leaf, × 35; **16.** leaf in cross section, × 350; **17.** basal leaf cells at right margin, × 175; **18.** laminal cells at right margin, × 350; **19.** leaf apex, × 175; **20.** part of capsule mouth showing cells, × 245; **21.** spore, × 500. (1−10, *Nicholson* 126B; 11−12 & 14−21, *Edwards* 827; 13, *MacLea* sub *Rehmann* 520).

wet. *Seta* 0,5−0,7 mm long, yellowish; capsule exposed, erect, cleistocarpic, globose to elliptical, 1,0−1,2 mm long, smooth, reddish yellow; exothecial cells angular, subquadrate to hexagonal; stomata present at base of urn, phaneropore; calyptra swollen, completely enclosing capsule, mitrate-rostrate, 1,3 mm long; spores immature, rounded, 30 μm, hyaline, weakly papillose with distinct tetrad scar. Fig. 90: 1−10.

Endemic to southern Africa, *P. africana* has been collected twice in fairly large colonies at the edge of coastal forests in Natal and Transkei. The exact type locality was not given and the site has not been precisely located. Map. 116.

Voucher: *Nicholas* 126B.

The lax, spathulate-acuminate leaves with dentate margins are fairly distinct and should help to place sterile specimens of *P. africana*. The short seta and exposed, globose to elliptical, cleistocarpic capsule and large calyptra are very distinctive; however also very small and easily overlooked on dried specimens.

5. PHYSCOMITRIUM

Physcomitrium *(Brid.) Fuernr.* in Flora, Jena 13: 9 (1829); Broth. in Natürl. PflFam. 10: 322 (1924); Sim, Bryo. S. Afr. 292 (1926). Type species: *P. sphaericum* (Ludw.) Fuernr., vide Grout, Moss Fl. N. Amer. 2: 74 (1935).

Gymnostomum subgen. *Physcomitrium* Brid., Bryol. Univ. 1: 97 (1826).

Plants mostly small, gregarious to loosely caespitose; terricolous. *Stems* unbranched; central strand present. *Leaves* crowded above, obovate-acuminate; margins bordered, serrate above. *Costa* subpercurrent to percurrent. *Laminal cells* rectangular to rhomboidal, smooth; narrower at margin.

Autoicous. *Seta* short or long; capsule cupulate, gymnostomous, mouth very broad; exothecial cells subquadrate to hexagonal; operculum plano-convex; calyptra mitrate, smooth; spores spinose.

Only a single species of *Physcomitrium* is known from southern Africa. The widespread genus contains approximately 83 species found on every continent except Antarctica.

The genus is most easily recognized by its cup-shaped, broad-mouthed capsules with very short necks. The exothecial cells are shorter (quadrate to hexagonal) than those found in *Funaria* (rectangular to rhomboidal) and the peristome is absent.

Physcomitrium spathulatum *(Hornsch.) C. Müll.* in Linnaea 18: 695 (1845); Sim, Bryo. S. Afr. 293 (1926). Type: Cape, between Kei and Bashee Rivers, *Drège* s.n., 1832.

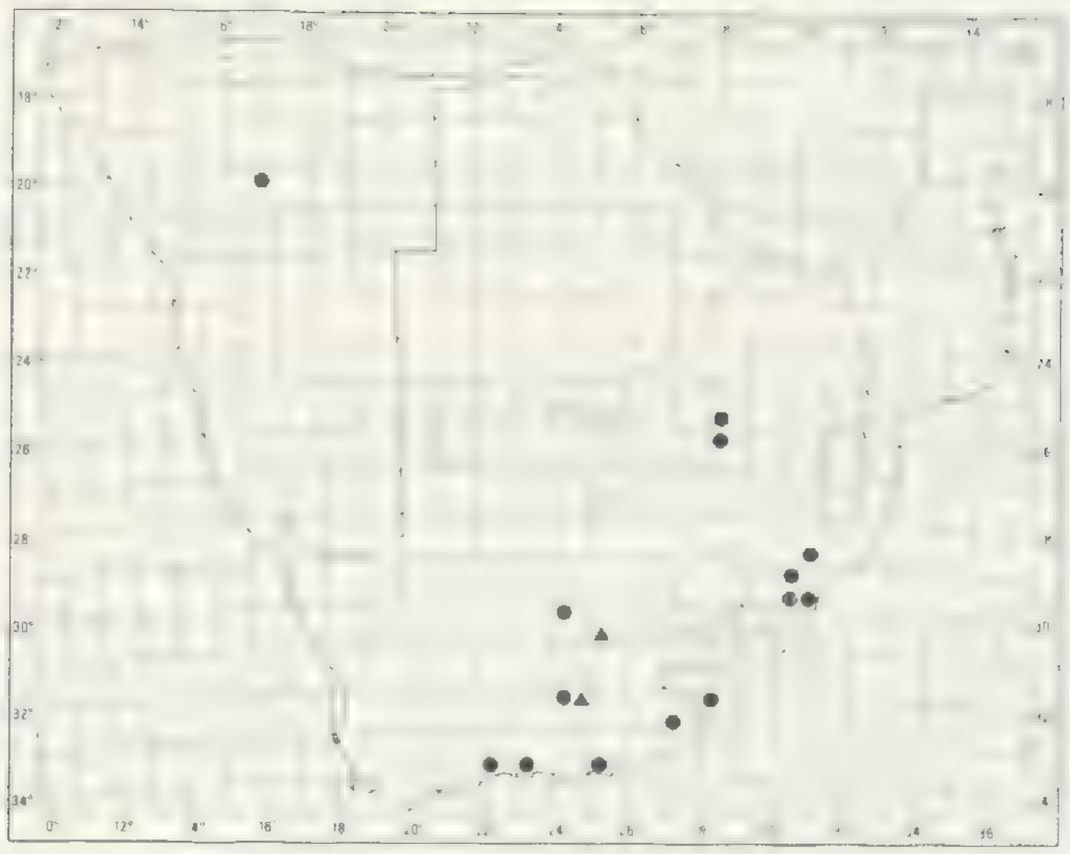
Gymnostomum spathulatum Hornsch. in Linnaea 15: 115 (1841).

Physcomitrium spathulatum var. *brevicollum* C. Müll., Syn. Musc. 1: 118 (1849). Syntype: Cape, *Pappe* s.n.; Philippstown, *Ecklon* s.n.

Physcomitrium brachypodium C. Müll. in Hedwigia 38: 59 (1899); Broth. in Natürl. PflFam. 10: 324 (1924). Type: Cape, Groot Visch River, *MacOwan* s.n., June 1877.

Plants small to medium-sized, gregarious, light green; terricolous. *Stems* 2−6 mm tall, simple; in section round, central strand a small group of thin-walled cells, inner cortical cells in 2−4 rows, large, thin-walled, outer cortical cells in 2 rows, smaller, weakly thickened. *Leaves* crowded above to rosulate, contorted dry, erect-spreading wet, lamina weakly undulate; obovate to subspathulate or occasionally elliptical, 2,5−4,5 mm long; apex acute to acuminate; margins weakly bordered, plane, serrate above. *Costa* ending below apex to just excurrent; in section subround, guide cells 2, small, ventral cells 2, in single row, larger than guide cells, weakly thickened, dorsal stereid band weak, 2−4 cells, frequently with gap below guide cells, dorsal surface cells similar to ventral cells. *Upper laminal cells* rectangular to oblong-hexagonal; marginal cells narrower, long-rectangular to linear, forming distinct border, thin-walled, upper ends of cells projecting as marginal serrations; basal cells rectangular.

Autoicous. Perichaetia terminal, leaves not distinct. *Seta* very short, 0,3−0,4 mm long or elongated (3−)5−8 mm long, reddish yellow; capsules, erect, symmetrical, stegocarpic, cupulate or rarely very short-cylindrical, 1,0−1,5 mm long, yellowish red, mouth broad, neck very small, sulcate when dry; exothecial cells subquadrate to hexagonal, thickened, but thin-walled in base, with 4−6 rows of transversely rectangular cells at mouth; stomata present on neck, phaneropore; *peristome* absent; operculum plano-convex, abruptly rostrate; calyptra



MAP 117.— ● **Physcomitrium spathulatum** var. **spathulatum**
▲ **Physcomitrium spathulatum** var. **sessile**

mitrate, 1,5 mm long, smooth; spores round, 22−30(−35) μm, reddish brown, spinose, with spines up to 3 μm long. Fig. 90: 11−21.

1 Seta 3−8 mm long ..... var. *spathulatum*
1 Seta 0,3−0,4 mm long ..... var. *sessile*

var. **spathulatum.**

Seta 3−8 mm long; capsule exserted; spores round, 22−30 μm, spinose.

Reported from southern Africa, Zimbabwe and Mozambique; in the Flora area the variety is infrequently collected in moist situations in South West Africa/Namibia, the central, eastern and southern Cape, Transkei, Natal and the central and southern Transvaal. Map 117.

Vouchers: *Edwards* 827; *Lambert* 17a; *Volk* 2226; *Wells* 54.

The short, erect, broad-mouthed, gymnostomous capsule exserted on a long seta should separate this variety from other taxa in Funariaceae. In addition the mitrate calyptra and bordered leaves are useful in identifying the variety.

var. **sessile** *(Shaw) Magill*, stat. nov. Lectotype: Cape, near Graaff-Reinet, *MacLea*, sub *Rehmann* 520 (PRE!; selected here; BM; BOL; NH).

Physcomitrium sessile Shaw in Cape Monthly Mag. 17: 316 (1878).

Seta 0,3−0,4 mm long; capsules immersed to emergent; spores round, 30−35 μm, coarsely spinose.

Endemic to southern Africa, *P. spathulatum* var. *sessile* is only rarely collected in the semi-arid grasslands of the eastern parts of the central Cape Province. Map 117.

Voucher: *Shaw* s.n., 1867.

This variety is similar in all vegetative respects and most sporophyte characters to the typical variety. The differences are the very short seta that results in immersed to emergent capsules, and the somewhat larger and more coarsely spinose spores.

Shaw (1878) described the costa as excurrent. While this is correct for some of the upper or perichaetial leaves, which have costae very short-excurrent, the costa ends well below the apex in most of the lower leaves.

This variety could be confused with *Physcomitrellopsis africana;* however its capsules are much smaller and cleistocarpic and its leaves are strongly toothed.

6. FUNARIA

Funaria *Hedw.*, Sp. Musc. 172 (1801); Broth. in Natürl. PflFam. 10: 325 (1924); Scott & Stone, Moss. S. Aust. 252 (1976); Smith, Moss Fl. Brit. Irel. 338 (1978). Lectotype species: *F. hygrometrica* Hedw., vide Britt. in N.L. Britt., Fl. Bermuda 441 (1916).

Entosthodon Schwaegr., Sp. Musc. Suppl. 2: 44 (1823); Sim, Bryo. S. Afr. 293 (1926); Grout, Moss Fl. N. Amer. 2: 78 (1935). Type species: *E. templetonii* (J.E. Sm.) Schwaegr.

Plants small to medium-sized, gregarious or loosely caespitose; terricolous. *Stems* erect, simple; in section round, central strand weak, inner cortical cells in 2−4 rows, large, thin-walled, outer cortical cells in 1−2 rows, smaller, incrassate, reddish yellow, epidermal cells large, thin-walled, frequently collapsed. *Leaves* larger above, in a rosette, weakly contorted dry, patent to widespreading wet; elliptical to obovate or subspathulate; apex acute to acuminate, occasionally apiculate to cuspidate; base mostly oblong; margins plane or occasionally broadly incurved, entire to crenulate or serrate, infrequently bordered. *Costa* ending below apex to percurrent, occasionally excurrent. *Laminal cells* rectangular, lax, frequently rhomboidal near apex; marginal cells generally narrower, infrequently thickened.

Autoicous. Perichaetia terminal; leaves weakly differentiated. *Seta* elongate; capsule stegocarpic, erect to pendent, symmetrical to asymmetrical, mostly pyriform, occasionally subcylindrical, neck generally well developed, sulcate; exothecial cells rectangular; stomata present on neck;

peristome single, double or absent; operculum plano-convex, apiculate; calyptra inflated-cucullate, rostrate, beak erect to oblique; spores papillose to granulate.

A large genus of approximately 220 species, *Funaria* is found on every continent except Antarctica. In southern Africa the genus is not common, but specimens are generally found in moist open areas in the eastern and southern parts of the Flora area. Perhaps the most widely recognized moss, *F. hygrometrica*, is practically cosmopolitan in its distribution and occasionally even considered a 'weed' in commercial greenhouses.

In his treatment of Funariaceae, Sim (1926) recognized nine species under *Entosthodon*, based on peristome development. Although this approach has been followed by many authors, the separation of *Entosthodon* and *Funaria*, even in southern Africa, is not altogether clear. Since an apparent gradation in peristome reduction is evident, I prefer to follow Brotherus (1924) in uniting all of the species under *Funaria*. In southern Africa the genus is most closely related to *Physcomitrium*; for differences see notes under that genus.

The southern African species of *Funaria* can be divided into two subgenera. The subgenus *Funaria* is identified by a double peristome, with the endostome well developed to very rudimentary, and the cells of the operculum frequently twisted counterclockwise when viewed from above. Three of the species found in the Flora area are included in this subgenus, i.e. *F. hygrometrica*, *F. rhomboidea* and *F. spathulata*. The remaining species fall within the subgenus *Entosthodon* (Schwaegr.) Lindb. This subgenus is recognized by its capsules being gymnostomous or having a single peristome which may be well developed or rudimentary. The cells of the operculum are not twisted or only very slightly so.

Since the peristomes of many of the species in the latter subgenus are fragile and lost soon after the capsule opens, their presence or absence is not used as a major character in the key. Only three of the southern African species appear to be truly gymnostomous. They are *F. clavata*, *F. longicollis* and *F. urceolata*.

1 Costa percurrent to excurrent in upper leaves:
  2 Leaves apiculate; capsules erect to slightly inclined:
    3 Leaves obovate to subspathulate; margins crenulate with a few strong teeth near apex ..... 5. *F. longicollis*
    3 Leaves elliptical or occasionally obovate; margins entire ..... 4. *F. rottleri*
  2 Leaves short-acuminate; capsules inclined to horizontal or pendent:
    4 Leaves narrowly obovate; capsules inclined, symmetrical; peristome absent ..... 6. *F. urceolata*
    4 Leaves broadly elliptical to obovate; capsules inclined to pendent, asymmetrical; peristome double ..... 10. *F. hygrometrica*
1 Costa ending below apex in upper leaves:
  5 Leaf margins serrulate to crenulate or occasionally dentate:
    6 Capsule asymmetrical, arcuate, if erect and straight then mouth obilque ..... 9. *F. spathulata*
    6 Capsules erect, symmetrical, pyriform or cylindrical above well defined neck:
      7 Leaves bordered by 1–2 rows of narrow, incrassate cells; margins serrulate to serrate ..... 1. *F. limbata*
      7 Marginal cells bulging, slightly larger than laminal cells; margins crenulate, frequently strongly so ..... 8. *F. rhomboidea*
  5 Leaf margins entire:
    8 Leaves bordered by 1–2 rows of narrow, incrassate cells ..... 1. *F. limbata*
    8 Leaves not bordered; marginal cells occasionally narrower than laminal cells:
      9 Leaf apices acute to obtuse; leaves broadly elliptical to obovate or occasionally ovate ..... 2. *F. succuleata*
      9 Leaf apices mucronate to apiculate or piliferous; leaves elliptical to obovate:
        10 Capsules erect, pyriform, 1,2–1,5 mm long; peristome present, fragile ..... 3. *F. bergiana*
        10 Capsules horizontal, clavate, to 4 mm long; peristome absent ..... 7. *F. clavata*

1. **Funaria limbata** *(C. Müll.) Broth.* in Natürl. PflFam. 1: 524 (1903); 10: 328 (1924). Type: Cape, Zitskamma, *Breutel* s.n. (BM!).

Entosthodon limbatus C. Müll. in Bot. Ztg 16: 155 (1858).

Entosthodon marginatus C. Müll., Syn. Musc. 1: 125 (1848); Sim, Bryo. S. Afr. 297 (1926). *Funaria marginata* (C. Müll.) Broth., hom. illeg., in Natürl. PflFam. 1: 525 (1903), non Kindberg (1883). Type: Cape, Swellendam, *Ecklon* s.n.

Entosthodon ampliretis C. Müll. in Hedwigia 38: 60 (1899). *Funaria ampliretis* (C. Müll.) Broth. in Natürl. PflFam. 1: 525 (1903); 10: 329 (1924). Type: Natal, Umgeni above Pietermaritzburg, *Rehmann* 174 (G!).

Entosthodon gracilescens C. Müll., hom. illeg., in Hedwigia 38: 59 (1899), non Schwaegr. ex C. Müll. (1858). Type: Transvaal, near Lydenburg, *Wilms* s.n., Feb. 1883 (G, holo.!).

Entosthodon micropyxis C. Müll. in Hedwigia 38: 60 (1899); *Funaria micropyxis* (C. Müll.) Broth. in Natürl.

PflFam. 1: 524 (1903); 10: 328 (1924). Type: Cape, near Blanco, *Rehmann* 175 (BM!; G!).

Physcomitrium leptolimbatum C. Müll. in Hedwigia 38: 59 (1899); Broth. in Natürl. PflFam. 1: 520 (1903). Type: Transvaal, near Lydenburg, *Wilms* s.n., Feb. 1888 (G, holo.!).

Entosthodon marginatus var. *obtusatus* Sim, Bryo. S. Afr. 297 (1926). *Funaria ampliretis* var. *obtusata* (Sim) Wijk & Marg. in Taxon 9: 189 (1960). Type: Natal, Umhwati, New Hanover, *Sim* 8585 (PRE, holo.!).

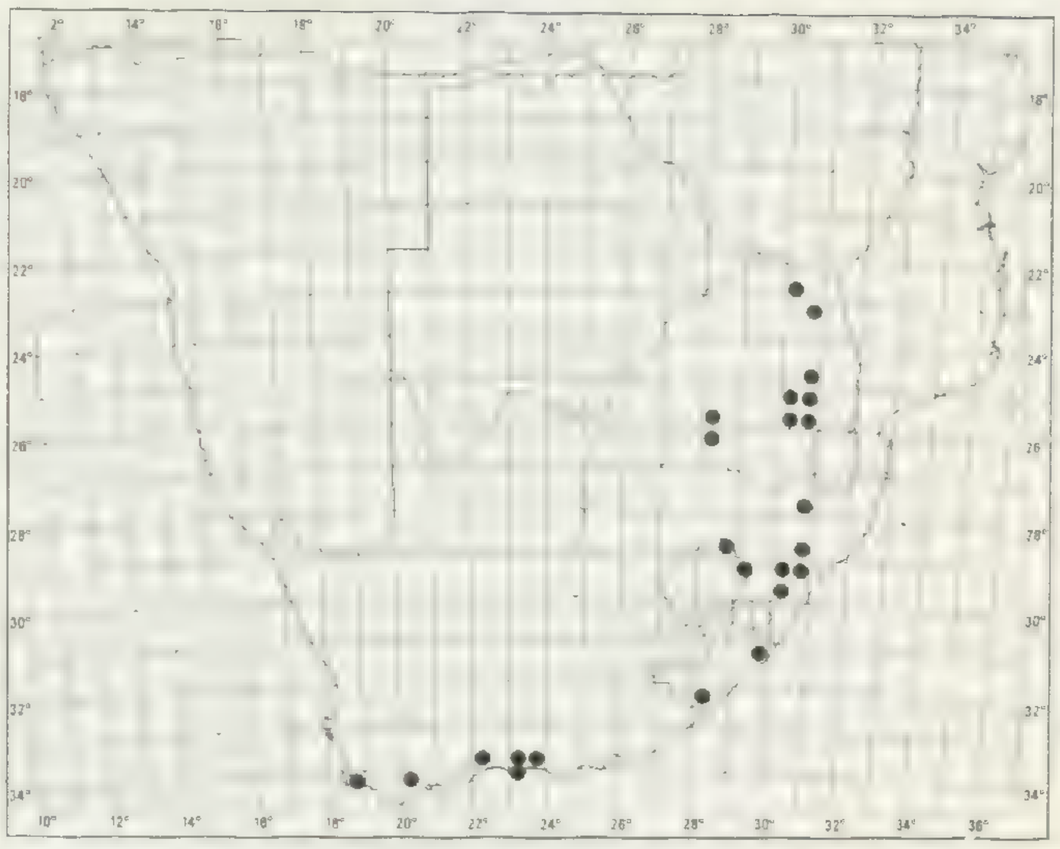
Plants small, scattered, light green to yellow-green; terricolous. *Stems* 1−2 mm long. *Leaves* larger and crowded above, contorted dry, widespreading wet; elliptical to obovate, 2−3(–4) mm long; apex acute to obtuse or occasionally rounded; base not differentiated; margins plane, entire to weakly serrate above, bordered by 1−2 rows of elongated, incrassate cells. *Costa* ending just below the apex; in section round, guide cells 2, small, thin-walled, ventral cells in single row, 2, small, thin-walled, dorsal stereid band small, 1−2 cells thick, reddish yellow, dorsal surface cells incrassate. *Laminal cells* short, oblong-hexagonal to rectangular or occasionally quadrate, thin-walled; marginal cells narrower, elongate, incrassate; basal cells rectangular, thin-walled.

Seta 6−11 mm long, reddish yellow; capsule erect, elliptical to short-cylindrical, 1−2 mm long, neck differentiated, urn frequently constricted under mouth when dry; exothecial cells rectangular, thickened, becoming shorter to quadrate in neck, with 4−8 rows of transversely rectangular to quadrate cells at mouth, thickened; stomata on neck, phaneropore; *peristome* single, irregular, teeth ± oblique, triangular, 175 μm high, irregularly perforated and absent with age, striate below, granulate above, reddish yellow; operculum plano-convex, short-apiculate, cells weakly twisted, counter clockwise; spores subround, 20−25 μm, light brown, vermiculate. Fig. 91: 1−13.

The species is known from eastern and southern Africa. In the Flora area the species is infrequently collected in the northern, eastern, central and southern Transvaal, Natal, Transkei and the southern and southwestern Cape. Map 118.

Vouchers: *Cholnoky* 51, 417a; *Crosby & Crosby* 8091; *Gordon-Gray* PRE-CH12820; *Oliver* 7308a; *Rankin* 54; *Russell* 2562.

The species is distinguished from the other southern African species of *Funaria* by its distinct border of narrow, elongate and thickened marginal cells. Although the border is occasionally weak, the cells are always more strongly differentiated than in the other species. Sterile specimens could be confused with *Physcomitrium* which also has bordered leaves. The marginal cells of *P. spathulatum*, however, are not thickened.



MAP 118.— ● **Funaria limbata**

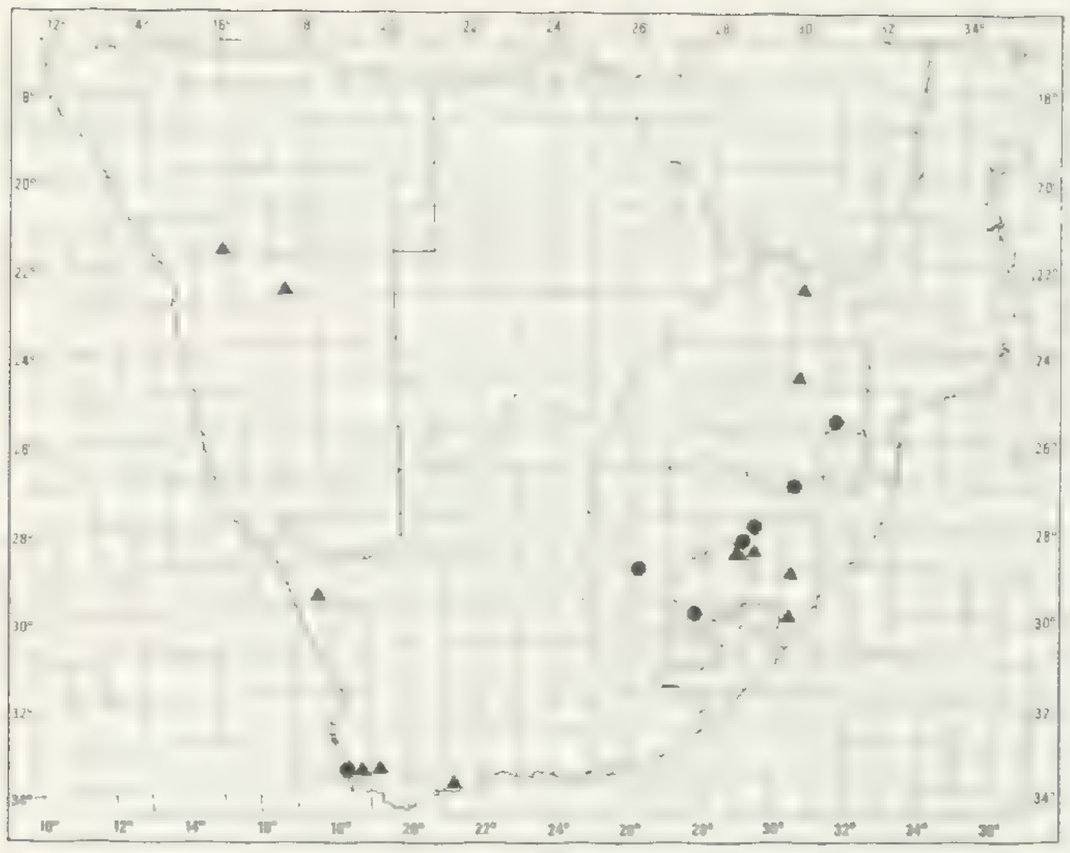
Several specimens have been seen with broadly elliptical leaves and rounded to obtuse apices, but agree in other respects to *F. limbata*. Although these specimens have been recognized as a variety [*F. ampliretis* var. *obtusata* (Sim) Wijk & Marg.] they are here considered to be just within the normal variation of this taxon.

2. **Funaria succuleata** *(Wager & Wright) Magill*, comb. nov. Type: Natal, Rydal Mount, *Wager* s.n. PRE-CH12075 (PRE, holo.!; BM).

Physcomitrium succuleatum Wager & Wright in Trans. R. Soc. S. Afr. 4: 3 (1914); Broth. in Natürl. PflFam. 10: 324 (1924).

Entosthodon cavifolius Mitt. in Harv., Thes. Cap. 1: 64 (1859); non *Funaria cavifolia* Card. & Broth. (1923). *Funaria harveyana* Magill in Mem. bot. Surv. S. Afr. 43: 7 (1979). Type: Cape, near Cape Town, *Harvey* s.n. (NY!).

Plants small, gregarious, light green; terricolous. *Stems* 2−4 mm long. *Leaves* crowded above, appressed, little contorted dry, erect-spreading wet; broadly elliptical to obovate or occasionally ovate, 1,5−2,0 mm long, concave; apex acute to obtuse; base scarcely differentiated, margins plane to broadly incurved above, entire. *Costa* ending below apex; in section guide cells 2, exposed ventrally, dorsal stereid band small, 2 cells thick, dorsal surface cells similar in size to guide cells, weakly thickened. *Laminal cells* rectangular, thin-walled, rhomboidal or occasionally rhombic near apex; marginal cells narrower and bulging but not forming distinct border; basal cells rectangular.



MAP 119.— ● **Funaria succuleata**
▲ **Funaria bergiana**

Seta to 4 mm long, reddish yellow; capsule erect, pyriform, 1,2−1,5 mm long, urn subglobose, neck very short; exothecial cells rectangular, thickened, with 2−3 rows of quadrate cells at mouth; *peristome* single, rudimentary and often missing on deoperculate capsules, teeth oblong, irregular, striate; operculum plano-convex, cells not twisted; spores round, 25 μm, reddish brown, weakly papillose. Fig. 91: 14−20.

Endemic to southern Africa, *F. succuleata* is found on soil of the southwestern Cape, Lesotho, Orange Free State, Natal and eastern Transvaal. Map 119.

Vouchers: *Magill* 4658; *Tölken* 5739a.

The species is recognized by its broadly elliptical to obovate leaves; entire, unbordered margins and costa that ends well below the apex. The leaves are generally concave and occasionally have broadly incuved margins that may obscure the typical leaf shape.

The new combination is provided since it does not appear that Brotherus ever made the combination indicated in Index Muscorum 2: 347 (1962). Brotherus frequently made a combination by citing in the genus, his new combination followed by the author and genus of the basionym. In this case, Natürl. PflFam. 10: 324 (1924), he only stated his opinion "*Ph. succuleatum* Wager & Wright, Südafr., gehört zu *Funaria (Entosthodon)*" at the end of his treatment of *Physcomitrium*.

The type at PRE is unfortunately mixed, because of Wager's practice of combining all subsequent collections of a species in a single packet. The specimen at BM, however, must have been sent soon after its collection, and hopefully is not a mixture.

3. **Funaria bergiana** *(Hornsch.) Broth.* in Natürl. PflFam. 1: 524 (1903); 10: 328 (1924). Type: Cape, "Montis Leonis", *Bergius* s.n., 15 Sept. 1816. (BM!).

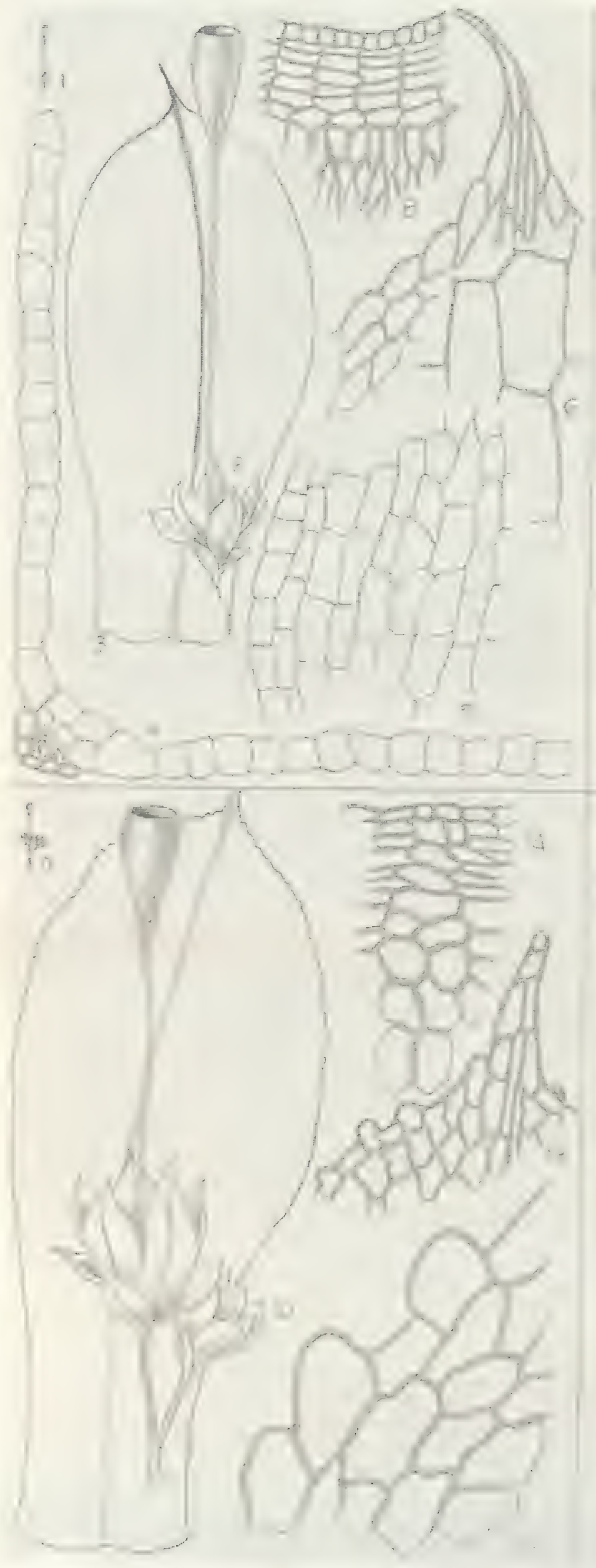
Weissia bergiana Hornsch., Hort. Phys. Berol. 59 (1820). *Entosthodon bergii* Bruch & Schimp., nom. illeg., in B.S.G., Bryol. Eur. 3: 256 (1841). *Physcomitrium bergianus* (Hornsch.) C. Müll. in Linnaea 18: 696 (1844). *Entosthodon bergianus* (Hornsch.) C. Müll., Syn. Musc. 1: 126 (1848); Sim, Bryo. S. Afr. 296 (1926).

Funaria gymnostoma Dix. in S. Afr. J. Sci. 18: 318 (1922). Type: Natal, Goodoo, *Wager* s.n., Jan. 1918, PRE-CH11990 (BM, holo., PRE!).

Plants small, gregarious, yellow-green to light green; terricolous. *Stems* 2−3 mm long. *Leaves* crowded above, weakly contorted and appressed dry, widespreading wet; elliptical to obovate, (1,5−)2,0−2,5 mm long; apex mucronate to apiculate, apiculus to 0,5 mm long, with linear, thickened cells, rarely absent on some leaves; base scarcely differentiated to oblong; margins plane, entire. *Costa* ending below apex; in section round, guide cells 2, exposed ventrally, dorsal stereid band weak, 2−3 cells thick, cells reddish, dorsal surface cells similar to guide cells. *Laminal cells* rectangular, rhomboidal and hexagonal; basal cells rectangular.

Seta 4−6 mm long, yellowish; capsule erect, pyriform, 1,2−1,5 mm long, yellowish brown, neck differentiated; exothecial cells rectangular, incrassate, sometimes strongly so, with 4−6 rows of quadrate to transversely rectangular cells at mouth; stomata present on neck; *peristome* single, fragile, teeth narrowly triangular, 0,17 mm long, striate below, papillose at apex, reddish yellow; operculum plano-convex, cells not twisted; spores rounded, 25−30 μm, yellowish brown, weakly papillose. Fig. 91: 21−27.

FIG. 91.—**Funaria limbata** (1−13): **1.** habit, × 1; **2.** habit, × 10; **3.** part of stem in cross section, × 245; **4.** leaf, × 35; **5.** leaf in cross section, × 175; **6.** basal leaf cells (right side), × 175; **7.** blunt leaf apex, × 175; **8.** acute leaf apex, × 175; **9.** laminal cells, × 350; **10.** capsule mouth and peristome teeth seen from above, × 87; **11.** part of capsule mouth showing cells, × 87; **12.** capsule, dry, × 10; **13.** spore, × 700. **F. succuleata** (14−20): **14.** habit, × 1; **15.** habit, × 10; **16.** leaf, × 35; **17.** basal leaf cells (right side), × 175; **18.** leaf apex, × 175; **19.** laminal cells, × 350; **20.** part of capsule mouth showing cells and peristome tooth, × 245. **F. bergiana** (21−27): **21.** habit, × 1; **22.** habit, × 10, **23.** leaf, × 35; **24.** basal leaf cells (right side), × 175; **25.** laminal cells, × 350; **26.** leaf apex, × 175; **27.** part of capsule mouth showing cells and peristome tooth, × 245. (1−6 & 8−13, *Thomas* PRE-CH2961; 7, *Sim* 8585; 14−20, *Wager* s.n., PRE-CH12075; 21−26, *Anderson* 6; 27, *Volk* 9581).



Endemic to southern Africa, *F. bergiana* has been collected from isolated communities in central South West Africa/Namibia, the western and southern Cape, Natal and eastern Transvaal. Map 119.

Vouchers: *Anderson* 6; *Garside* 6589; *Magill* 3135; *Schelpe* 7772.

Funaria bergiana is recognized by its apiculate or muticous leaves with costa ending below the apex and its erect, symmetrical capsules. Bruch and Schimper (1841) described and illustrated the costa of the lower stem leaves as 'costa excurrente mucronatis'. I have not seen leaves with the costa excurrent, however the costa is frequently longer, even to subpercurrent in the lower leaves. Cells of the apiculus are elongated and generally incrassate and could give the impression of an excurrent costa.

Remnants of a peristome were found on the only capsule seen of *F. gymnostoma;* this and its leaf shape indicate its relationship to *F. bergiana*.

MAP 120.— ● **Funaria rottleri**

4. **Funaria rottleri** *(Schwaegr.) Broth.* in Natürl. PflFam. 1: 525 (1903); 10: 329 (1924). Type: Tranquebar, *Rottler* s.n. (G, holo.!).

Gymnostomum rottleri Schwaegr., Sp. Musc. Suppl. 1: 24 (1811). *Physcomitrium rottleri* (Schwaegr.) Hampe ex C. Müll. in Linnaea 18: 696 (1845). *Entosthodon rottleri* (Schwaegr.) C. Müll., Syn. Musc. 1: 121 (1848); Sim, Bryo. S. Afr. 294 (1926).

?*Entosthodon campylopodioides* C. Müll. in Hedwigia 38: 60 (1899); Dix. in Trans. R. Soc. S. Afr. 8: 199 (1920); Sim, Bryo. S. Afr. 294 (1926). Type: Orange Free State, Taaibosch Kranz, Rhenoster River, *Rehmann* s.n., 1875 (G!).

Plants small, scattered, light green to yellow-green; terricolous. *Stems* 2–5 mm long. *Leaves* crowded above, in a rosette, weakly contorted dry, widespreading wet; elliptical to obovate, 2–4 mm long; apex acute to apiculate; margins plane, entire or marginal cells bulging above. *Costa* short-excurrent, mucro to 0,5 mm long; in section guide cells 2, thin-walled, ventral surface cells 2, thin-walled, dorsal stereid band 2–6 cells thick, reddish, dorsal surface cells smaller than guide cells, incrassate. *Laminal cells* short-rectangular, thin-walled, becoming rhomboidal near apex; basal cells rectangular.

Seta 5–10 mm long, reddish brown; capsule erect to inclined, cylindrical to obconical, 3–4 mm long, reddish brown, mouth very broad, urn constricted below mouth when dry, neck differentiated; exothecial cells oblong-hexagonal, incrassate, with 4–6 rows of transversely rectangular cells at mouth; *peristome* very rudimentary or absent; operculum plano-convex, cells not twisted; spores subround 20–25 μm, brownish, papillose. Fig. 92: 1–8.

Reported from Asia and Africa, *F. rottleri* is quite widespread in the eastern and southern parts of the Flora area. The species grows on soil in open grasslands and shrublands of the western, central and eastern Transvaal, Orange Free State, Lesotho, Natal, Transkei and the eastern, southern, central, northern and southwestern Cape. Map 120.

Vouchers: *Ellis* 3103; *Hardy et al.* 5339a; *Jacot Guillarmod* 8201; *Magill* 4549, 4757; *Vahrmeijer* PRE-CH12690; *Van Rooy* 509; *Von Breitenbach* 96.

Most similar to *F. longicollis*, but differing in smaller leaves with entire margins and longer, ± inclined capsules; see note under that species.

5. **Funaria longicollis** *Dix.* in S. Afr. J. Sci. 18: 318 (1922); Broth. in Natürl. PflFam. 10: 327 (1924); 11: 530 (1925). Syntypes: Zimbabwe, Zimbabwe Ruins, *Sim* 8735, 8796, 8797; Khami Ruins, *Sim* 8842 (BM; PRE!).

Entosthodon dixonii Sim, Bryo. S. Afr. 296 (1926), non *E. longicollis* Mitt. (1869).

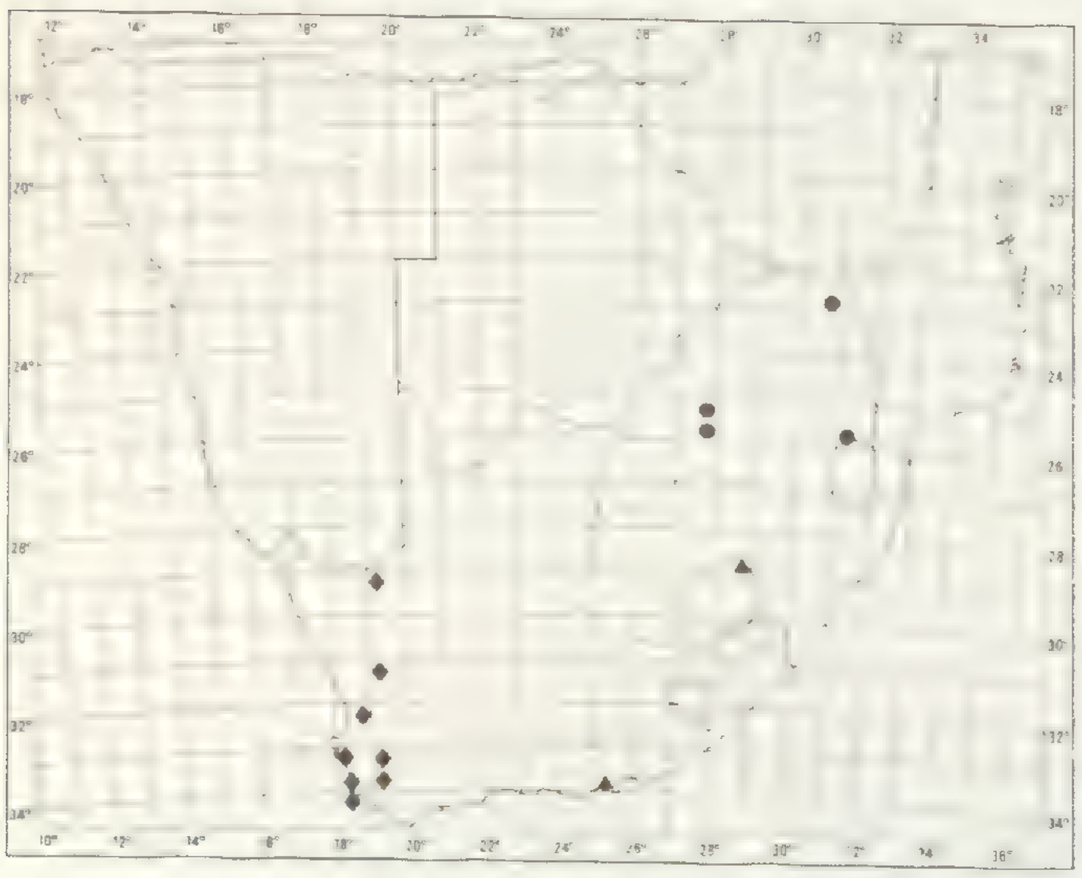
FIG. 92.—**Funaria rottleri** (1–8): **1.** habit, × 1; **2.** habit, × 10; **3.** leaf, × 35; **4.** leaf in cross section, × 200; **5.** basal leaf cells (left side), × 175; **6.** laminal cells, × 350; **7.** leaf apex, × 175; **8.** part of capsule mouth showing cells, × 175. **F. longicollis** (9–14): **9.** habit, × 1; **10.** habit, × 10; **11.** leaf, × 35; **12.** laminal cells at upper margin, × 350; **13.** leaf apex, × 175; **14.** part of capsule mouth showing cells, × 350. **F. urceolata** (15–22): **15.** habit, × 1; **16.** habit, × 10; **17.** leaf, × 35; **18.** laminal cells, × 350. **19.** leaf apex, × 175; **20.** capsule, dry, × 10; **21.** exothecial cells, × 350; **22.** part of capsule mouth showing cells, × 350. **F. clavata** (23–28): **23.** habit, × 1; **24.** habit, × 10; **25.** leaf, × 35; **26.** basal leaf cells, × 175; **27.** leaf apex, × 175; **28.** laminal cells, × 600. (1–8, *Magill* 4213; 9–14, *Sim* 8735; 15–22, *Rooper* s.n.; 23–28, *Magill* 4003).

Plants small to medium-sized, scattered, green to dark green; terricolous. *Stems* 2–5 mm long. *Leaves* larger and crowded above, contorted dry, widespreading wet; obovate to subspathulate, 3–4 (–5) mm long; apex acute to obtuse, apiculate; base oblong; margins plane, entire below, crenulate above, frequently irregularly so with some strong teeth near apex. *Costa* short excurrent, mucro to 0,2 mm long; in section round, guide cells 2, small, thin-walled, ventral cells in single row, slightly larger than guide cells, thin-walled, dorsal stereid band 2–3 cells thick, reddish, dorsal surface cells larger than guide cells, thin-walled. *Laminal cells* rectangular, becoming rhomboidal above; marginal cells bulging, thin-walled; basal cells short-rectangular.

Seta 5–7 mm long, reddish yellow; capsule erect, narrowly pyriform, 2,0–2,5 mm long, red-brown, urn cylindrical, constricted below mouth when dry, neck differentiated, sulcate; exothecial cells rectangular, incrassate, with 8–10 rows of transversely rectangular cells at capsule mouth; stomata present on neck, phaneropore; *peristome* absent, occasionally with traces of rudimentary membrane; calyptra plano-convex, cells very slightly twisted; spores rounded, 25–30 μm, yellowish, sparsely papillose with distinct tetrad scar (probably immature). Fig. 92: 9–14.

The species has been collected only a few times in southern Zimbabwe and in the northern, eastern and central Transvaal. Map 121.

Vouchers: *Magill* 5018; *Van Rooy* 613, 621.



MAP 121.— ● **Funaria longicollis**
▲ **Funaria urceolata**
◆ **Funaria clavata**

Similar in many respects to *F. rottleri*, but differing in larger leaves with crenulate margins and smaller, erect capsule. The spores of the two species also differ in size and *F. longicollis* lacks a peristome. The peristome of *F. rottleri* is rudimentary and fragile and missing on older capsules.

6. **Funaria urceolata** *(Mitt.) Magill* in Mem. bot. Surv. S. Afr. 43: 7 (1979). Type: Cape, East London, *Rooper* s.n. (NY, holo.!).

Entosthodon urceolatus Mitt. in Harvey, Thes. Cap. 1:63 (1859).

Funaria rufinervis Dix. in Trans. R. Soc. S. Afr. 18: 254 (1930). Type: Natal, National Park, *Wager* 758 (BM, holo.!; PRE!).

Plants small, scattered, light green; terricolous. *Stems* 3–5 mm long. *Leaves* crowded and larger above, weakly contorted dry, widespreading wet; lingulate to narrowly obovate, 3,0–3,5 mm long; apex short-acuminate; base oblong; margins plane, entire. *Costa* short excurrent, mucro 0,2–0,3 mm long; in section round, guide cells 2, weakly thickened, ventral cells in single row, thin-walled, dorsal stereid band weak, 2 cells thick, dorsal surface cells similar to ventral cells, thin-walled. *Laminal cells* irregularly short-rectangular, thin-walled; basal cells rectangular, thin-walled.

Seta 4–5 mm long, reddish yellow; capsule inclined, narrow-pyriform, 2–3 mm long, mouth wide, urn constricted below mouth when dry, neck differentiated, sulcate; exothecial cells rectangular to rhomboidal, incrassate, short rectangular to quadrate or hexagonal in neck, thin-walled, with 4 rows of transversely rectangular cells at mouth and 1–2 rows of larger, ± quadrate cells just below; stomata present on neck, subphaneropore; *peristome* absent; calyptra not seen, described as short-conic, subplano-convex; spores subround, 27–30 μm, brownish, vermiculate to bluntly papillose. Fig. 92: 15–22.

Endemic to southern Africa, *F. urceolata* is known from the mountains of Natal and the southern Cape. Map 121.

Vouchers: *Sim* 10126; *Wager* 758.

The species is recognized by its narrow leaves with short-excurrent costa, and narrowly pyriform, inclined, gymnostomous capsules.

7. **Funaria clavata** *(Mitt.) Magill*, comb. nov. Type: Cape of Good Hope, *Menzies* s.n. (NY, holo.!).

Entosthodon clavata Mitt. in Harvey, Thes. Cap 1:63 (1859).

Plants medium-sized, scattered, yellow-green; terricolous. *Stems* 2–4 mm long. *Leaves* crowded and larger above, appressed dry, widespreading wet; elliptical to broadly elliptical or obovate, 2,0–3,2 mm long; apex abruptly or gradually apiculate to piliferous; base not differentiated; margins plane, entire. *Costa* ending below apex; in section bulging dorsally, guide cells 3, thin-walled, ventral cells in single row, larger than guide cells, thin-walled, dorsal stereid band small, 1–2 cells thick, dorsal surface cells small, incrassate. *Laminal cells* rectangular, thin-walled; basal cells larger, rectangular.

Seta 6 mm long, red-brown; capsule horizontal, clavate, 4 mm long, red-brown, neck not strongly differentiated, nearly smooth; exothecial cells rectangular to rhomboidal, strongly incrassate, in base shorter, quadrate to hexagonal, thin-walled, with 4 rows of transversely rectangular cells at capsule mouth; stomata present at base of neck; *peristome* absent; operculum flat, cells not twisted; spores rounded, 25 μm, brownish yellow, weakly papillose with tetrad scar (probably immature). Fig 92: 23–28.

Endemic to southern Africa; the species is collected on soil in the shrublands of the western Cape. Map 121.

Vouchers: *Magill & Schelpe* 3845, 4003; *Perold* 481; *Schelpe* 7716; *V.d. Westhuizen* 40.

Funaria clavata is a distinctive species, identified by its broadly elliptical-apiculate leaves with costa ending below the apex and its horizontal, gymnostomous, clavate capsules.

8. **Funaria rhomboidea** *Shaw* in Cape Monthly Mag. 17: 315 (1878). Type: Cape, near Graaff-Reinet, *McLea* s.n., sub *Rehmann* 523. (NH!).

Entosthodon schinzii Geheeb in Bull. Herb. Boissier 4: 411 (1896). *Funaria schinzii* (Geheeb) Broth. in Natürl. PflFam. 1: 524 (1903). Type: South West Africa/Namibia, Comagas, *Schinz* s.n., 24 Apr. 1885 (Z!).

Entosthodon rivale Geheeb in Bull. Herb. Boissier 4: 411 (1896). *Physcomitrium rivale* (Geheeb) Broth. in Natürl. PflFam. 1: 519 (1903). Type: South West Africa/Namibia, *Schinz* s.n., Apr. 1885 (Z!).

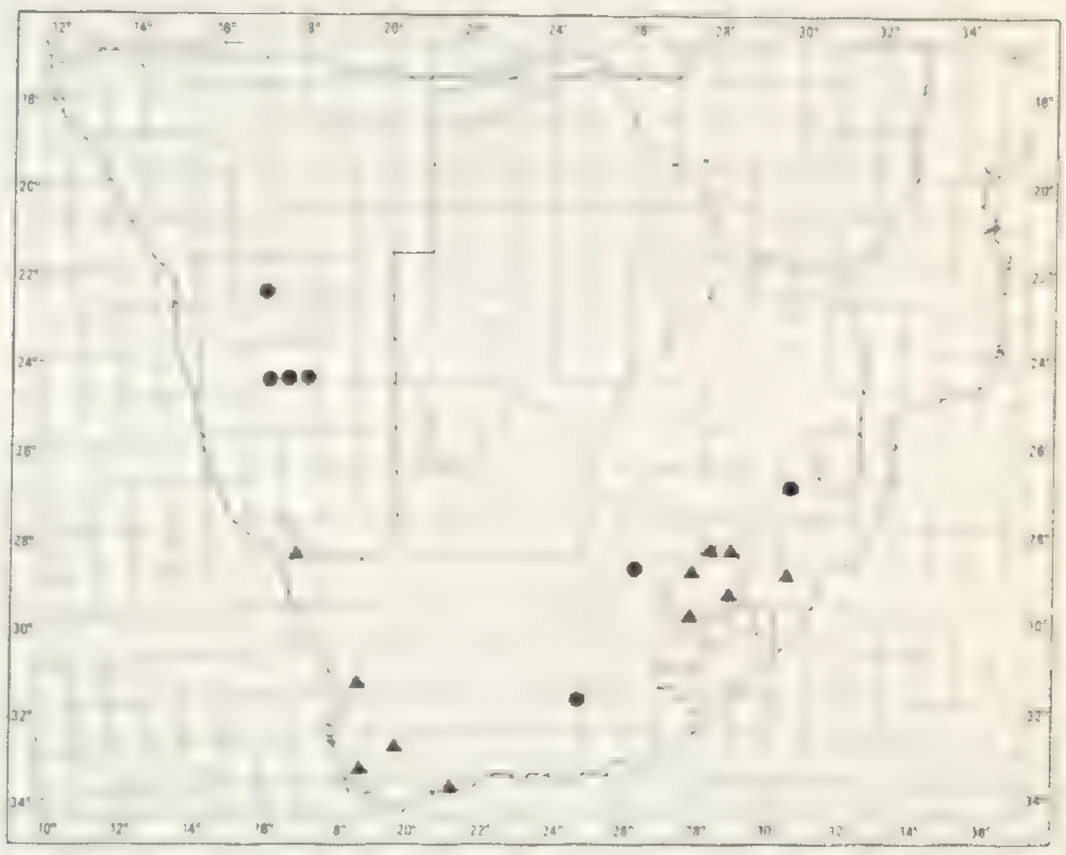
Plants small, scattered, yellowish green; terricolous. *Stems* 2–3 mm long. *Leaves* crowded above, in a rosette, weakly contorted dry, widespreading wet; elliptical to obovate, 2,5–3,5 (–4,5) mm long; apex acute to obtuse-apiculate, occasionally very short acuminate; base oblong; margins plane, crenulate to bluntly toothed above base, occasionally strongly so. *Costa* ending well below apex; in section rounded, guide cells 2, thin-walled, ventral cells 2, in single layer, thin-walled, dorsal stereid band weak, 2–3 cells thick, dorsal surface cells thin-walled. *Laminal cells* rectangular to rhomboidal, thin-walled, becoming somewhat irregular to rhombic át apex; marginal cells slightly larger, bulging at distal ends to form crenulate margin; basal cells rectangular.

Seta 6–7 mm long, reddish yellow; capsules erect, pyriform, 1,5–2,0 mm long, reddish brown, urn short cylindrical or occasionally inflated and globose, neck strongly sulcate, collapsed wet or dry; exothecial cells rhomboidal, thickened, with 2–4 rows of transversely rectangular cells at mouth, stomata present on neck; *peristome* double, exostome teeth irregular, perforated, red-yellow, 0,10–0,15 mm long, vertically striate below, papillose above, endostome rudimentary, attached to teeth, yellowish, smooth; operculum short-conic, cells twisted counter-clockwise; spores round, 25–35 μm, brownish, weakly papillose. Fig. 93:1–8.

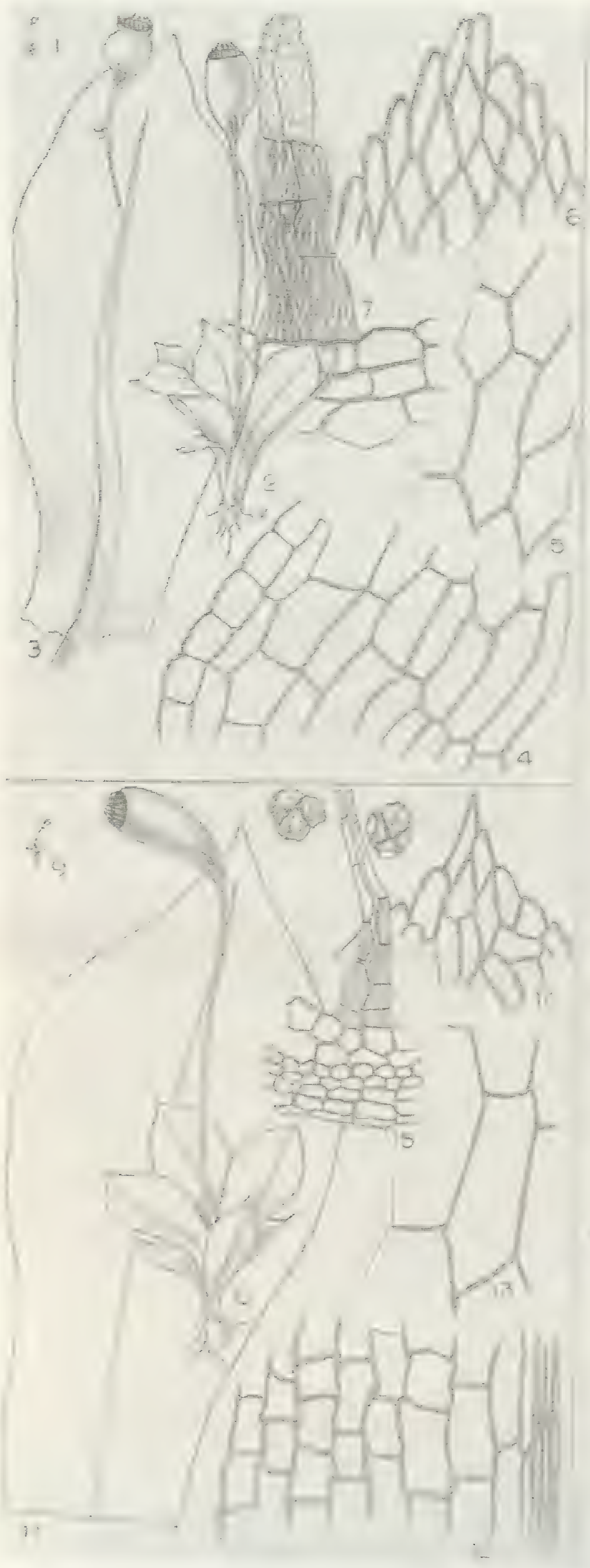
Endemic to southern Africa, *F. rhomboidea* is found in dry grassland communities of central South West Africa/Namibia, the central Cape, Orange Free State and northern Natal. Map 122.

Vouchers: *Potts* 4; *Tölken* 5737; *Volk* 481, 5374, 12458.

Although considered a nomen nudum by Sim (1926) and the authors of Index Muscorum (1962), Shaw (1878) provided a short discription in English when he published *F. rhomboidea*.



MAP 122.— ● **Funaria rhomboidea** ▲ **Funaria spathulata**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This species is similar to *F. limbata*, but differs in the absence of a well defined border. The marginal cells in *F. rhomboidea* are slightly larger with the upper ends of the cells bulging outward resulting in a crenulate margin. It is also similar to *F. spathulata* differing primarily in capsule shape and size.

The type specimen of *Entosthodon schinzii* Geheeb agrees well with *Funaria rhomboidea*. Only fragments of the peristome were found in the mouth of the capsule examined, however their structure seems to indicate a peristome similar to that of *F. rhomboidea*.

The type of *Entosthodon rivale* Geheeb contains slightly larger plants, but otherwise agrees gametophytically with *F. rhomboidea*. All of the sporophytes seen were immature, so the original reference to a gymnostomous capsule could not be substantiated. The capsule shape and exothecial cells clearly indicate *Funaria* as the proper genus for the species.

9. **Funaria spathulata** *Schimp.* ex *C. Müll.* in Hedwigia 38: 61 (1899); Broth. in Natürl. PflFam. 10: 330 (1924). Type: Cape, Groenkloof, ***Breutel*** s.n. (BM, holo.!; G!).

Entosthodon spathulatus (C. Müll.) Sim, Bryo. S. Afr. 298 (1926).

Funaria dieterlenii Thér. in Bull. Mus. Hist. nat., Paris 30: 240 (1924); Broth. in Natürl. PflFam. 11: 530 (1925). Type: Lesotho, Leribe, *Dieterlen* s.n. (PC, holo.!).

Plants small to medium-sized, scattered or gregarious, light green to yellow-green; terricolous. *Stems* 2–4 mm long. *Leaves* larger and crowded above, spirally contorted dry, widespreading wet; broadly elliptical to obovate or subspathulate, (1,5–)2,0–3,5 mm long; apex acute to short-acuminate; base oblong or scarcely differentiated; margins plane, crenulate to denticulate. *Costa* ending below apex to almost percurrent, in section round, guide cells 2, thin-walled, ventral cells in single layer, 2, thin-walled, dorsal stereid band small and weak, 2 cells thick, dorsal surface cells similar to guide cells, weakly thickened. *Laminal cells* rectangular or rhomboidal at apex; basal cells rectangular.

Seta (5–)8–10 mm long, yellowish brown; capsule asymmetrical, erect to inclined with oblique mouth to arcuate with mouth vertical, 1,5–2,5 mm long, yellow-brown, neck short, well defined; exothecial cells on convex surface rectangular, thickened, but irregular and shorter on concave surface, on neck short-quadrate to angular, thin-walled; stomata present on neck, phaneropore; *peristome* double, exostome teeth narrowly triangular, perforated, 0,3 mm long, occasionally somewhat irregular, not twisted, coarsely striated, reddish yellow, endostome rudimentary, weakly papillose, yellow; operculum plano-convex, cells not twisted; spores rounded, 23–32 μm, red-brown, strongly papillose to vermiculate. Fig. 93: 9–15.

Endemic to southern Africa, *F. spathulata* is collected in locally moist areas of the western and southern Cape, Natal and Lesotho. Map 122.

Vouchers: *Magill* 4226, 4622; *Oliver et al.* 647; *Schelpe* 4917a; *Schmitz* 8111.

This species is macroscopically similar to *F. hygrometrica*, but distinct in its costa consistently ending below the apex, its more erect capsules, rudimentary endostome and cells of the operculum not twisted. There is also a resemblance to *F. rhomboidea*, however its capsules differ in size and shape and the twisted cells of the operculum.

10. **Funaria hygrometrica** *Hedw.*, Sp. Musc. 172 (1801); Broth. in Natürl. PflFam. 10: 331 (1924); Sim, Bryo. S. Afr. 298 (1926); Crum, Moss. Great Lakes Forest 135 (1973); Scott & Stone, Moss. S. Aust. 254 (1976); Smith, Moss Fl. Brit. Irel. 340 (1978). Type: Europe.

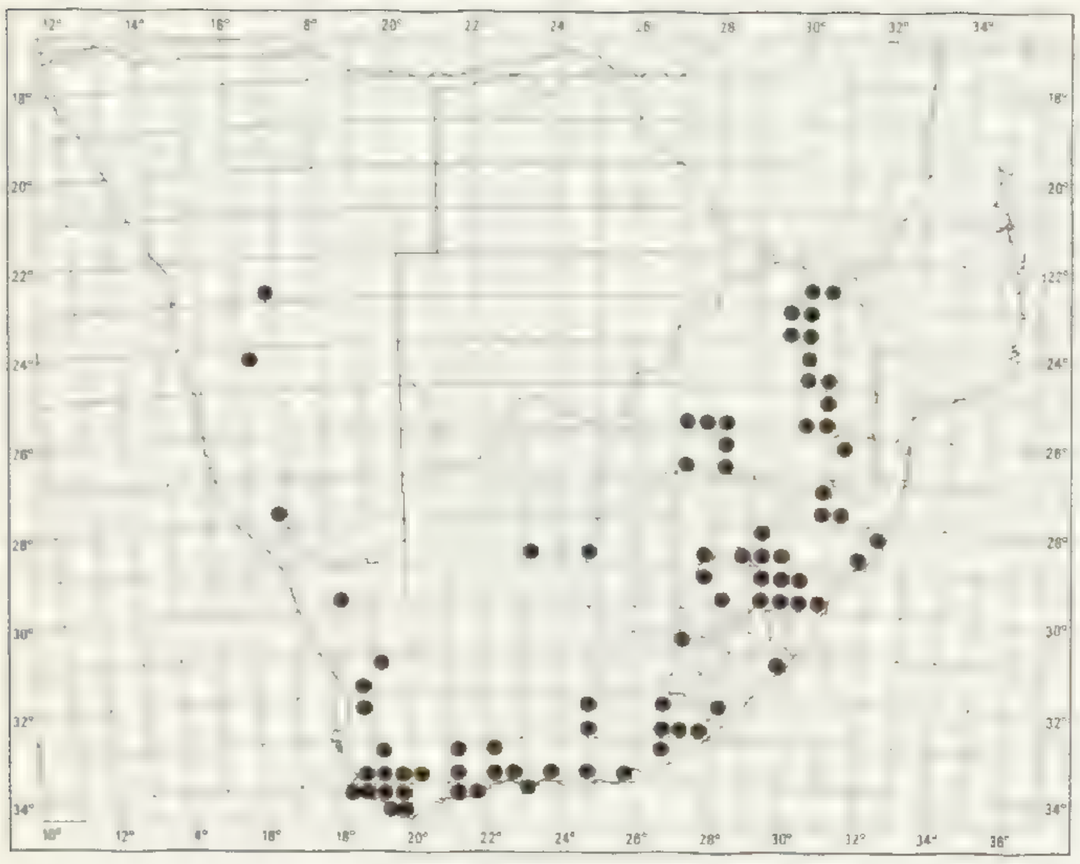
Funaria plagiostoma C. Müll. in Bot. Ztg 13: 748 (1855). *Entosthodon plagiostomus* (C. Müll.) Sim, Bryo. S. Afr. 297 (1926). Syntypes: Cape, prope Swellendam, *Mundt; Pappe*.

Funaria gracilescens Schimp. ex C. Müll. in Bot. Ztg 16: 154 (1858); Broth. in Natürl. PflFam. 10: 332 (1924). Type: Cape, Zitzkamma, *Breutel* s.n. (BM, holo.!).

Funaria lonchopelma C. Müll. in Hedwigia 38: 61 (1899). Type: Cape, Montagu Pass, *Rehmann* 181 (BM!).

Plants medium-sized, gregarious, light green; terricolous. *Stems* 3–8 mm long. *Leaves* imbricate in bulb-like cluster, weakly contorted dry; broadly elliptical to obovate, 2–4 mm long, concave; apex acute to short acuminate; margins plane to broadly inrolled above, entire to

FIG. 93.—**Funaria rhomboidea** (1–8): **1.** habit, × 1; **2.** habit, × 10; **3.** leaf, × 35; **4.** basal leaf cells at left margin, × 175; **5.** laminal cells, × 350; **6.** leaf apex, × 175; **7.** part of capsule mouth showing cells and peristome tooth, × 350; **8.** capsule, dry, × 10. **F. spathulata** (9–15): **9.** habit, × 1; **10.** habit, × 10, **11.** leaf, × 35; **12.** basal leaf cells (left side), × 175; **13.** laminal cells, × 350; **14.** leaf apex, × 175; **15.** part of capsule mouth showing cells, peristome tooth and spore tetrads, × 175. **F. hygrometrica** (16–25): **16.** habit, × 1; **17.** habit, × 10; **18.** leaf, × 35, **19.** basal leaf cells (right side), × 175; **20.** laminal cells, × 350; **21.** leaf apex, × 175; **22.** operculum (split and flattened by coverslip), × 70; **23.** part of capsule mouth showing cells and peristome, × 175; **24.** capsules, dry and operculate on left, wet and deoperculate on right, × 10; **25.** calyptra, × 10. (1–8, *Rehmann* 523; 9–15, *Dieterlen* 686; 16–21 & 23–25, *Garside* 6628; 2, *Wood* 282).



MAP 123.— ● **Funaria hygrometrica**

weakly serrate. *Costa* ending just below apex to short excurrent; in section round, guide cells 4, ventral cells in single row of 2–3 cells, larger than guide cells, thin-walled, dorsal stereid band small, 2–4 cells thick, dorsal surface cells similar in size to guide cells, incrassate. *Laminal cells* inflated, subhexagonal to short rectangular, somewhat narrower at margin; basal cells oblong.

Seta 20–50 mm long, yellowish; capsules horizontal to pendent, asymmetrical, arcuate, subpyriform, to 3 mm long, reddish brown, sulcate, mouth oblique, neck differentiated, sulcate when dry; exothecial cells rectangular, thin-walled, irregular and shorter on concave surface, at mouth with 4–8 rows of transversely rectangular cells, neck cells quadrate to angular; stomata present on neck; annulus well developed, revoluble; *peristome* double, exostome teeth sigmoid, triangular-twisted, joined at apex to an ephemeral, cancellate disk, ventral surface papillose-striate below, papillose above, dorsal surface strongly trabeculate, endostome segments lanceolate, papillose, cilia absent; operculum convex, cells twisted counter-clockwise; spores round, 14–17 μm, yellow-brown, smooth. Fig. 93: 16–25.

Almost cosmopolitan in its distribution *F. hygrometrica* is the most frequently collected and widespread species of *Funaria* in southern Africa. Map 123.

Vouchers: *Crosby & Crosby* 7585; *De Winter* 9378a; *Esterhuysen* 18578; *Garside* 6545; *Hardy* 5003; *Lambert* 8; *Magill* 3431, 4619, 6286; *Perold* 5; *Phelan et al.* 60; *Pienaar* 15; *Smook* 887; *Van Rooy* 1, 453; *Wells* 70.

The plants of *F. hygrometrica* are generally the largest of any of the species present in southern Africa. The asymmetrical, horizontal to pendulous, sulcate capsules are very distinctive, and with their broad oblique mouths, strongly developed, revoluble annulus and double peristome will quickly place the species.

SPLACHNACEAE

Plants medium-sized to large, forming loose tufts, dark green; terricolous. *Stems* erect, radiculose below; central strand present. *Leaves* lingulate to obovate; margins frequently serrate to dentate above. *Costa* strong, generally excurrent; in section with guide cells and stereid bands. *Laminal cells* hexagonal to oblong-rhomboidal, smooth.

Monoicous. Perichaetia terminal. *Seta* erect; capsule symmetrical, urn cylindrical, neck frequently differentiated; peristome single, teeth 16, usually fused in pairs; operculum conic; calyptra campanulate, rough or hairy; spores small.

Primarily a Northern Hemisphere family containing 7 genera, Splachnaceae is generally collected on decaying organic matter. Only a single genus, *Tayloria*, is known from southern Africa.

TAYLORIA

Tayloria *Hook.* in Jl Sci. Arts, Lond. 2: 144 (1816); Broth. in Natürl. PflFam. 10: 336 (1924); Sayre in Grout, Moss Fl. N. Amer. 2: 93 (1935); Sainsb., N. Zeal. Mosses 249 (1955); Gangulee, Moss. E. India 4: 874 (1974); Smith, Moss Fl. Brit. Irel. 352 (1978). Type species: *T. splachnoides* (Schwaegr.) Hook.

With characters of family.

The genus *Tayloria* contains approximately 60 species that are rather evenly distributed. The largest concentration of species is found in northwestern South America. Seven species are known from the African mainland and until recently, only from the tropics above 15 ° S latitude. *Tayloria orthodonta* (P. Beauv.) Demar. has been reported from Zimbabwe (Magill & Schelpe 1979) and *T. isleana* (Besch.) Broth. is now known from southern Africa, its only locality outside Réunion. The genus bears some vegetative resemblance to members of Mniaceae, but the sporophytes are very distinctive.

1 Leaves toothed in upper third, upper marginal cells and dentations more strongly thickened than laminal cells; calyptra sparsely hairy ..... 1. *T. isleana*

1 Leaves toothed in upper half; upper marginal cells not differentially thickened; calyptra papillose ..... 2. *T. orthodonta*

1. **Tayloria isleana** *(Besch.) Broth.*, Natürl. PflFam. 1 (3): 503 (1903); 10: 339 (1924); Koponen & Weber in Ann. Bot. Fenn. 9: 131 (1972). Type: Réunion, G. del'Isle, *Lepervanche* 410, 1877 (BM!).

Orthodon isleanus Besch., Ann. Sci. Nat. Bot. Ser. 6, 9: 373 (1880).

Plant medium-sized to large, loosely caespitose, dark green to yellow-green; terricolous. *Stem* erect, 8–12 mm long, simple; in section round, central strand large, inner cortical cells large, in 4–5 rows, thin-walled, outer cortical cells smaller, in 2–3 rows, thick-walled. *Leaves* larger above, when wet widespreading, when dry erect-appressed; obovate, 2,5–3,0 mm long, apex obtuse, cuspidate, base oblong, margins plane, entire below, strongly and sharply dentate or spinose above, teeth multicellular, directed forward, to 0,2 mm long, apical cell elongated. *Costa* strong, short excurrent, awn 0,3–0,6 mm long, smooth; in section round, bulging dorsally, guide cells 2, exposed ventrally, ventral stereid band absent, dorsal stereid band weak, 2–3 cells thick, dorsal surface cells larger than guide cells, thick-walled. *Upper laminal cells* somewhat variable in size and shape, mostly rectangular-rhomboidal, 45–100 μm long, 30–38 μm wide, walls thin, smooth; marginal cells and cells of teeth somewhat thickened; basal cells rectangular.

Autoicous. Perichaetia at apex, perichaetial leaves similar to vegetative leaves, 2,0–2,5 mm long. *Seta* 6–7 mm long, yellowish; capsule ovoid, 1,5–2,0 mm long, constricted below mouth when dry, reddish yellow; exothecial cells rounded quadrate to rectangular or angular; stomata on lower urn, subphaneropore; *peristome* single, light yellow, teeth 16 in 8

FIG. 94.—**Tayloria isleana** (1–10): **1.** habit, × 1; **2.** habit, × 10; **3.** portion of stem in cross section, × 175; **4** & **5.** leaves, × 35; **6.** leaf in cross section, × 175; **7.** basal leaf cells at right margin, × 175; **8.** upper laminal cells, × 400; **9.** leaf apex, × 175; **10.** peristome tooth and part of capsule mouth, × 160. **T. orthodonta** (11–16): **11.** habit, × 1; **12.** habit, × 5; **13.** leaf, × 17; **14.** leaf in cross section, × 175; **15.** basal leaf cells (left side), × 70; **16.** leaf apex, × 175. (1–10, *Reid* 7211; 11–16, *Rehmann* 559).

MAP 124.— ● Orthodontium lineare
▲ Tayloria isleana
◆ Tayloria orthodonta

pairs, triangular, weakly papillose, 0,45 μm high; operculum conic; calyptra campanulate, 3,0–3,5 mm long, hairy; spores rounded, 10–14 μm, more or less smooth, light yellow. Fig. 94: 1–10.

The species was previously known only from Réunion. The southern African specimen was collected in Karkloof, northwest of Pietermartizburg, Natal in 1915, but was only recently discovered in a mixed collection. Map 124.

Voucher: *Reid* 7211a.

The species can be indentified by its obovate-cuspidate leaves with strongly toothed upper margins and leaf cells that are large, thin-walled and smooth. *Tayloria orthodonta* differs in having a shorter apiculus and papillose calyptra.

2. **Tayloria orthodonta** *(P. Beauv.) Wijk & Marg.* in Taxon 17: 467 (1968).

Bryum orthodontum P. Beauv., Prodr. Cinq. Six. Fam. Aetheogam. 48 (1805).

Plant medium-sized to large, caespitose, yellow-green; terricolous. *Stem* erect, to 15 mm long, simple; in section round, central strand large, inner cortical cells large, in 4–6 rows, thin-walled, outer cortical cells in 2–3 rows, thick-walled. *Leaves* when wet widespreading, when dry appressed, stem leaves oblong to obovate, 4,0–4,5 mm long, apex subacute to obtuse, awned; base oblong; margins plane, entire below, dentate in upper half, teeth multicellular, apical cell not differentiated. *Costa* strong, short excurrent, awn 0,2–0,3 mm long, smooth; in section bulging dorsally, guide cells large, 2–3, thickened, ventral stereid band absent, ventral surface cells large, thick-walled, dorsal stereid band strong, 6–8 cells thick, dosal surface cells large, thick-walled. *Upper laminal cells* rectangular to rectangular-hexagonal, walls thickened, marginal cells thin-walled, smooth, basal cells rectangular, walls thin, smooth.

Autoicous. Perichaetia at apex, perichaetial leaves similar to vegetative leaves. Fig. 94: 11–16.

The species is known from Guinea through equatorial Africa to Malawi and Réunion. This is the first report of the species to South Africa. The specimen was collected by Rehmann in woods at Houtbosch in the northern Transvaal. Map 124.

Voucher: *Rehmann* 559.

The southern African specimen has the remnants of a seta but other parts of the sporophyte are missing. The species is similar to *T. isleana* with the important difference of a papillose rather than hairy calyptra. The upper marginal cells in this species are not thickened and the apical cells of the marginal teeth are not elongated.

BRYACEAE

by J. VAN ROOY and R. E. MAGILL

Plants small to robust, solitary to caespitose or forming dense cushions, generally yellow-green to dark green or reddish green, occasionally glossy or with metallic lustre; terricolous, saxicolous, corticolous or humicolous. *Stems* erect, infrequently from rhizomes, simple or frequently branched by subperichaetial innovations, in section with central strand; frequently tomentose; tubers occasionally present. *Leaves* variable in size and shape, equidistant to crowded above or in a rosette, mostly smaller below, imbricate or appressed to erect-spreading, straight or variously twisted when dry; margins plane to recurved, entire to variably dentate, border present or absent. *Costa* ending below apex, percurrent or excurrent as long or short awn; in section bulging dorsally, ventral stereid band absent, generally with dorsal stereid band. *Laminal cells* mostly rhomboidal, smooth; basal cells quadrate to rectangular. Propagulae, gemmae or filamentous gemmae infrequently produced.

Dioicous, variably monoicous or heteroicous. Perichaetia terminal or quickly lateral through innovations, leaves not strongly differentiated. *Seta* elongate, erect; capsule erect to pendulous, generally pyriform, straight or rarely curved, neck differentiated; stomata on neck; annulus frequently differentiated; *peristome* double or rarely single, exostome teeth 16, endostome segments keeled, alternating with teeth, cilia present or absent, basal membrane low or high; operculum convex, apiculate, mammillate or rostellate; calyptra cucullate, smooth; spores round, smooth to papillose.

Nine of the twenty genera recognized in Bryaceae are known from southern Africa. Members of the family are easily recognized by their sporophytic characters. The seta is long with a relatively large capsule, mostly inclined to pendulous and generally pyriform in shape with the neck tapering to the seta. The peristome is generally double and frequently well developed. The endostome frequently has a high basal membrane with 16 segments alternating with the exostome teeth and with intermediate cilia varying in number. The peristome is variously reduced in some of the genera. Infrageneric variation in peristome development is common in the Bryaceae and *Rhodobryum* is the only non-monotypic genus in the Flora area in which the peristome is uniformly well developed. Sterile plants can be recognized by the leaves frequently crowded towards the stem apex with the lower leaves distant and smaller, the smooth, rhomboidal laminal cells and the strong costae.

1 Leaf cells elongate, mostly 4 times or more as long as broad (>4:1); leaves generally narrow:
  2 Leaves imbricate, equidistant; stems frequently julaceous ..... 7. **Anomobryum**
  2 Leaves appressed to erect-spreading, crowded above, distant below, rarely equidistant; stems not julaceous:
    3 Leaves setaceous or linear:
      4 Costa broad; exostome teeth as long as segments; endostome cilia present ..... 6. **Leptobryum**
      4 Costa narrower; exostome teeth shorter than segments; endostome cilia absent ..... 1. **Orthodontium**
    3 Leaves ovate to lanceolate:
      5 Sporophytes quickly lateral; peristome double, frequently appearing single, exostome teeth rudimentary, short ..... 2. **Mielichhoferia**
      5 Sporophytes terminal; peristome double, exostome teeth long:
        6 Costa percurrent or ending below apex ..... 4. **Pohlia**
        6 Costa excurrent ..... 8. **Bryum**
1 Leaf cells shorter, mostly less than 4 times as long as broad (<4:1); leaves generally broad:
  7 Leaves imbricate, equidistant; costa percurrent; upper laminal cell walls thickened to incrassate ..... 7. **Anomobryum**

7 Leaves appressed to erect-spreading or variously twisted, crowded above, distant below; if imbricate and equidistant then costa excurrent or upper laminal cells thin-walled:

8 Plants mostly corticolous, rarely terricolous; capsules erect to horizontal, mouth small:

9 Perichaetium a short, basal bud or quickly lateral through innovation; peristome double, frequently appearing single, exostome teeth rudimentary, short..... 2. **Mielichhoferia**

9 Perichaetium terminal but overgrown by subperichaetial innovation; peristome double, exostome teeth ± long..... 3. **Brachymenium**

8 Plants mostly terricolous, rarely corticolous; capsules inclined to pendulous, mouth large:

10 Stems frequently erect from rhizomes; upper leaves crowded in a conspicuous rosette with lower leaves reduced; polysetaceous ..... 9. **Rhodobryum**

10 Rhizomes absent; leaves equidistant and about equal in size, comose or crowded in rosettes with lower leaves smaller; unisetaceous:

11 Plants small, reddish hyaline; leaves broadly ovate; exostome teeth shorter than endostome segments..... 5. **Plagiobryum**

11 Plants small to robust, whitish or silvery green or variously green; leaves ovate to lanceolate or oblong to obovate or spathulate; exostome not shorter than segments ..... 8. **Bryum**

1. ORTHODONTIUM

Orthodontium *Schwaegr.*, Sp. Musc. Suppl. 2 (2): 123 (1827); Broth. in Natürl. PflFam. 10: 349 (1924); Sim, Bryo. S. Afr. 317 (1926); Meijer in Act. bot. neerl. 1: 5–80 (1952); Sainsb., N. Zeal. Mosses 254 (1955); Scott & Stone, Moss. S. Aust. 296 (1976); Smith, Moss Fl. Brit. Irel. 361 (1978); Catcheside, Moss. South Austr. 243 (1980). Type species: *O. lineare* Schwaegr.

Plants small, loosely caespitose; terricolous or corticolous. *Stems* erect, little branched; in section round, central strand of collapsed cells present, cortical cells in 3–4 rows. *Leaves* erect-spreading or flexuose, linear-lanceolate. *Costa* generally ending below apex; in section with guide cells exposed ventrally. *Upper laminal cells* long-rhomboidal, basal cells frequently bulging.

Autoicous, synoicous or heteroicous. *Capsule* erect or inclined, ovate or pyriform; stomata phaneropore; annulus apparently absent; peristome double, exostome teeth generally shorter than segments, cilia absent, basal membrane low; operculum rostellate; calyptra small, cucullate; spores round.

Orthodontium is a world-wide genus of 14 species. Vegetatively the genus may be confused with members of Dicranaceae but the capsule and peristome characters will place it in Bryaceae. Sterile specimens are identified by size, leaf shape and areolation.

Orthodontium lineare *Schwaegr.*, Sp. Musc. Suppl. 2 (2): 188 (1827); Broth. in Natürl. PflFam. 10: 350 (1924); Sim, Bryo. S. Afr. 317 (1926); Meijer in Act. bot. neerl. 1: 28 (1952); Sainsb., N. Zeal. Mosses 255 (1955); Scott & Stone, Moss. S. Aust. 298 (1976); Smith, Moss Fl. Brit. Irel. 361 (1978); Catcheside, Moss. South Austr. 245 (1980). Type: Cape, *Menzies* s.n. (G, holo.).

Plants small, loosely caespitose, yellow-green or green above, brownish below; terricolous or corticolous. Stems 1–5 mm tall, irregularly branched, yellowish brown to reddish brown; rhizoids smooth, brownish or reddish.

Leaves crowded, larger above, erect-spreading or flexuose wet or dry, linear-lanceolate or linear, (1−)2−4(−6) mm long; apex acuminate to setaceous, frequently reddish below; margins plane, entire to denticulate above. *Costa* generally weak, ending below apex to subpercurrent; in section round to subround, guide cells exposed ventrally, dorsal stereid band strong, stereids in 3−4 rows, dorsal surface cells in 1 row, incrassate. *Upper laminal cells* rhomboidal to linear-rhomboidal, (80−)100−150 (−200) μm long, (7,5−)10,0−18,75 μm wide; basal cells larger, frequently reddish, bulging, rhomboidal or subrectangular.

Autoicous, synoicous or heteroicous. Perichaetial leaves linear-lanceolate. *Seta* 10−13 mm long, yellow or reddish, slightly twisted; capsule erect or inclined, ovate, cylindrical or pyriform, urn 1,0−1,5 mm long, yellowish to reddish brown, neck wrinkled dry, 0,2−0,6 mm long; exothecial cells irregularly rectangular, thin-walled, shorter and incrassate above; stomata at base of urn and on neck, phaneropore; annulus apparently absent; *peristome* yellowish, exostome teeth distant, trabeculate ventrally, linear, to 200 μm long, minutely papillose, endostome segments generally longer, alternating with teeth, linear, nodose, cleft below, extending into basal membrane, cilia absent, basal membrane low, minutely papillose; operculum conical, rostellate; calyptra small, cucullate, ephemeral; spores 22−26 μm, brownish. Fig. 95.

This species is known from Australia, New Zealand, Europe and southern Africa. In the Flora area it is rarely collected on soil or bark in the southwestern Cape and Zululand. Map 124.

Vouchers: *Magill* 5386; *Magill & Schelpe* 4102; *Pillans* 4271; *Thorne* PRE-CH3643.

Orthodontium lineare can be distinguished from other taxa in Bryaceae by the erect to inclined capsule, the peristome with teeth shorter than the nodose segments and the low basal membrane without cilia.The linear leaves with long-rhomboidal cells and the smooth rhizoids are also distinctive.

FIG. 95.—**Orthodontium lineare: 1.** habit, × 1; **2.** habit, × 3; **3.** stem in cross section, × 175; **4.** leaf, × 17; **5.** leaf in cross section, × 175; **6.** basal leaf cells (right side), × 175; **7.** laminal cells at right margin, × 175; **8.** leaf apex, × 175; **9.** capsule, × 15; **10.** stomatal apparatus, × 350; **11.** part of capsule mouth showing cells and peristome, × 175; **12.** spore, × 700. (1−3, 5 & 7−12, *Thorne* PRE-CH3643; 4 & 6, *Magill* 4102).

2. MIELICHHOFERIA

Mielichhoferia *Nees & Hornsch.*, Bryol. Germ. 2: 179 (1831); Broth. in Natürl. PflFam. 10: 350 (1924); Sim, Bryo. S. Afr. 314 (1926); Andrews in Grout, Moss Fl. N. Amer. 2: 184 (1935); Sainsb., N. Zeal. Mosses 252 (1955); Gangulee, Moss. E. India 4: 892 (1974); Scott & Stone, Moss. S. Austr. 295 (1976); Smith, Moss Fl. Brit. Irel. 359 (1978). Type species: not designated.

Schizymenium Harv. in Hooker's Icon. Pl. 3: 202 (1840). Type species: *S. bryoides* Harv.

Plants small to medium-sized, densely caespitose, light green to yellow-green, occasionally glossy; terricolous. *Stems* erect, generally branched; in section with central strand. *Leaves* ovate to lanceolate, not distinctly larger above; margins unbordered, plane, entire to denticulate. *Costa* ending below apex to percurrent or occasionally very short excurrent; in section with dorsal stereid or substereid band. *Upper laminal cells* elongate rhomboidal to linear-rhomboidal; shorter and broader toward base, rectangular.

Dioicous. Perichaetia quickly lateral through elongation of subperichaetial innovation, leaves weakly differentiated from vegetative leaves. *Seta* elongate, erect; capsule nearly erect to inclined, pyriform, neck short; peristome double, frequently appearing single, exostome teeth rudimentary, short, blunt, endostome fragile, segments 16, linear, on a low basal membrane, occasionally rudimentary, cilia absent; operculum convex; calyptra small, deciduous; spores rounded, finely papillose.

Mielichhoferia contains c. 126 species, primarily of Southern Hemisphere distribution. The major centre of described species is found in South America.

Shaw and Crum (1984) found that *Mielichhoferia* is synonymous with and has priority over *Haplodontium* Hampe, and species traditionally included in *Haplodontium* have been transferred to *Mielichhoferia*. Several species traditionally included in *Mielichhoferia* have been transferred to *Schizymenium* by Shaw (1985). Southern African species are treated here as *Mielichhoferia* until their positions in the subfamily Mielichhoferioideae are determined.

Mielichhoferia is similar in many respects to *Pohlia*, but the genera can be separated on a combination of mostly sporophytic characters. These characters can be summarized as follows: in *Mielichhoferia*, the perichaetia are produced on a short, basal bud or quickly lateral through elongation of a subperichaetial innovation; because the plants are densely packed the perichaetia are buried in the dense tuft. The peristome is double but appears single as the exostome teeth are rudimentary and rarely visible above the annulus. The basal membrane and 16 linear segments of the endostome are fragile and quickly lost on deoperculate capsules. A result of the weak and non-functional condition of the peristome is the rapid loss of spores from the erect to inclined capsule.

In *Pohlia* the perichaetia are terminal on an elongated shoot and branching of this shoot is rare. As a result the perichaetia are exposed and not overgrown by the plant. The peristome is double, consisting of 16 exostome teeth and an endostome with basal membrane, broad segments and frequently cilia. The peristome is persistent and evident even on very old capsules. This complete, functional peristome retains spores in the inclined to pendent capsules until suitable conditions for dispersal exist.

1 Leaves lanceolate to oval-acuminate, 1–2 mm long ..... 1. *M. bryoides*

1 Leaves broadly elliptical or ovate, concave, 0,4–1,0 mm long ..... 2. *M. subnuda*

1. **Mielichhoferia bryoides** *(Harv.) Wijk & Marg.* in Taxon 11: 221 (1962); Scott & Stone, Moss. S. Austr. 295 (1976); Catcheside, Moss. South Austr. 242 (1980). Type: Cape, *Harvey* s.n. (BM, holo.!).

Schizymenium bryoides Harv. in Hooker's Icon. Pl. 3: 202 (1840).

Mielichhoferia ecklonii Hornsch. in Linnaea 15: 118 (1841); Broth. in Natürl. PflFam. 10: 352 (1924); Sim, Bryo. S. Afr. 316 (1926); Sainsb., N. Zeal. Mosses 254 (1955). Syntypes: Cape, *Zeyher* s.n.; Löwenrücken, *Ecklon* s.n., 24 Aug. 1824; Hottentots Hollands Mountains, *Ecklon* s.n., 24 Oct. 1824 (BM!).

? *Mielichhoferia rehmannii* C. Müll. in Hedwigia 38: 64 (1899); Dix. in Trans. R. Soc. S. Afr. 8: 199 (1920); Broth. in Natürl. PflFam. 10: 353 (1924). Type: Cape, Devil's Peak, *Rehmann* 313.

Mielichhoferia transvaaliensis C. Müll. in Hedwigia 38: 64 (1899); Broth. in Natürl. PflFam. 10: 351 (1924); Sim, Bryo. S. Afr. 315 (1926). Type: Transvaal, Duivels Krackler, near Lydenburg, *Wilms* s.n., Apr. 1887 (G, holo.!).

Plants small to medium-sized, loosely caespitose, light green, somewhat glossy; terricolous or saxicolous. *Stems* (2–)5–10 mm high, infrequently branched; in section angular,

central strand small, inner cortex in 3 rows, cells large, thin-walled, outer cortical cells in 2 rows, cells of inner row small, incrassate, outer row stereids, reddish brown. *Leaves* appressed to erect dry, erect-spreading wet; lanceolate to ovate- or oval-acuminate, rarely ovate-acute, (0,7−)1,0−1,8(−2,0) mm long; margins plane, entire below, weakly serrate above. *Costa* ending below apex to subpercurrent or infrequently percurrent; in section rounded, bulging dorsally, guide cells 2, incrassate, ventral cells in single row, 2−4, incrassate, dorsal stereid band 2−3 cells thick, frequently with hydroids below guide cells, dorsal surface cells small, incrassate. *Upper laminal cells* mostly 6−15: 1, elongate-rhomboidal to linear-rhomboidal (50−)75−150 μm long, 7−10 μm wide; basal cells weakly differentiated, generally shorter, rectangular, occasionally quadrate.

Paroicous or synoicous. Perichaetia on short, lateral branch, leaves slightly shorter, triangular. *Seta* 8−10 (−15) mm long, yellow-brown; capsules erect to inclined or infrequently pendent, ± asymmetrical, weakly curved, subpyriform, (2,0−)2,5−3,0 mm long, yellow-brown to dark brown, neck weakly differentiated wet, collapsed dry, 0,5−1,0 mm long; exothecial cells ± irregular, rectangular to angular, 1−2 rows at mouth smaller, quadrate; stomata present on neck, phaneropore; annulus differentiated; peristome double, frequently appearing single, exostome teeth rudimentary, short and blunt, rarely visible above annulus, perforated, ± smooth, yellowish, endostome with low basal membrane, segments 16, linear, 170−200 μm high, appendiculate, frequently anastomosing, ± smooth to variously papillose, cilia absent; operculum convex; spores round, 18−22 μm, weakly papillose, light brown. Fig. 96: 1−11.

The species is reported from eastern and southern Africa, Australia, New Zealand and several subantarctic islands. In the Flora area the species is found in shrublands, grasslands and forest margins of the southwestern, southern and eastern Cape, Natal, Lesotho and the eastern, central and northern Transvaal. Map 125.

Vouchers: *Cholnoky* 940; *Crosby & Crosby* 9103; *Esterhuysen* 15697; *Magill* 4298, 4494; *Oliver* 6730; *Van Rooy* 1005.

A lot of variation in plant size and leaf size and length is accommodated in this circumscription of *M. bryoides*, and it may be more correct to consider this a species complex. For example the type of *M. bryoides* has narrower leaves (lanceolate) than the types of *M. transvaaliensis* or *M. ecklonii* (± ovate-acuminate). The leaves of *M. bryoides* are also longer (to 2 mm) than those of either *M.*

MAP 125.— ● **Mielichhoferia bryoides**

transvaaliensis (±1,5 mm) or *M. ecklonii* (0,8−1,2 mm). Although the extremes appear distinct, the specimens are treated as a single species since there is almost a continual gradation in leaf size and shape, and additional separating characters were not found.

Van Zanten (1973) included *M. ecklonii* in the synonymy of *M. campylocarpa* (Hook. & Arnott) Mitt. After examining several specimens identified by Van Zanten as *M. campylocarpa* from Marion Island, as well as several other species of *Mielichhoferia* from the subantarctic islands, it was decided not to refer the southern African specimens of *M. campylocarpa* at this time. The most significant differences between Marion Island and southern African specimens are: (1) spore size, (2) leaf width in base, and (3) capsule stature.

Variation in height of the endostome basal membrane was found to be quite variable, vide Sim (1926) and Van Zanten (1973), so the separation of *M. transvaaliensis*, based primarily on that character, has not been maintained.

A small group of specimens from Natal and Lesotho (*Cholnoky* 91; *Dieterlen* 790; *Magill* 4343) differ in having distinctly quadrate basal cells on most leaves. Although other specimens have weakly differentiated to rectangular basal cells, some leaves (especially lower ones) occasionally have quadrate cells. The specimens have therefore, provisionally been placed here.

2. **Mielichhoferia subnuda** *Sim*, Bryo. S. Afr. 315 (1926). Lectotype: Natal, Mooi River, *Sim* 10197 (PRE!, selected here).

Mielichhoferia cholnokyi P. Varde in Revue Bryol. lichen. 24: 31 (1955). Type: Natal, Drakensberg, Fairy Glen, *Cholnoky* 18 (PC, holo.!).

Plants small, loosely caespitose, yellow-green to light green or brownish; terricolous. *Stems* 2−5 mm tall, infrequently branched; in section round, central strand very small, inner cortex in 2−3 rows, cells thin-walled, outer cortex in 1−2 rows, cells with inner walls

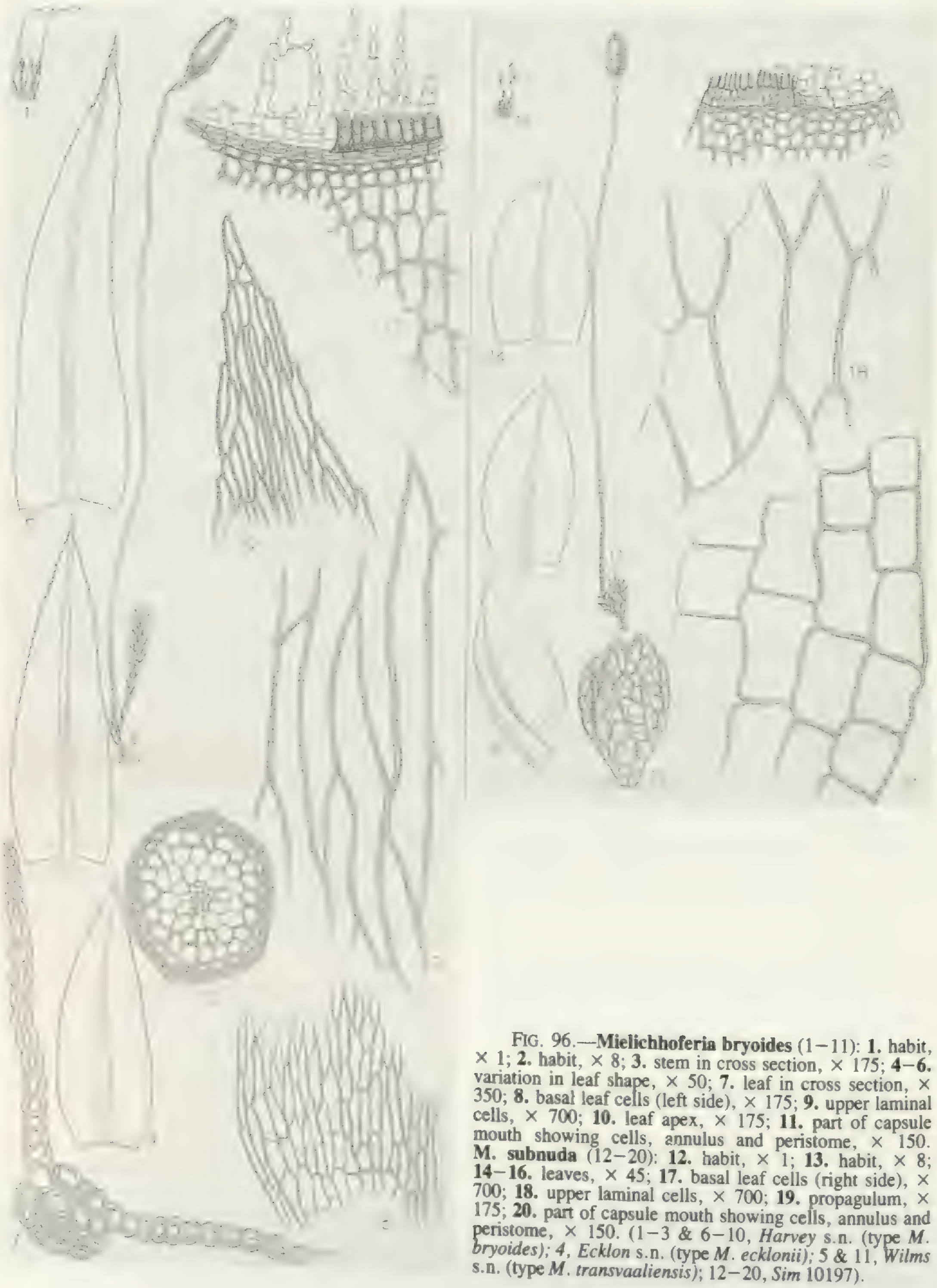
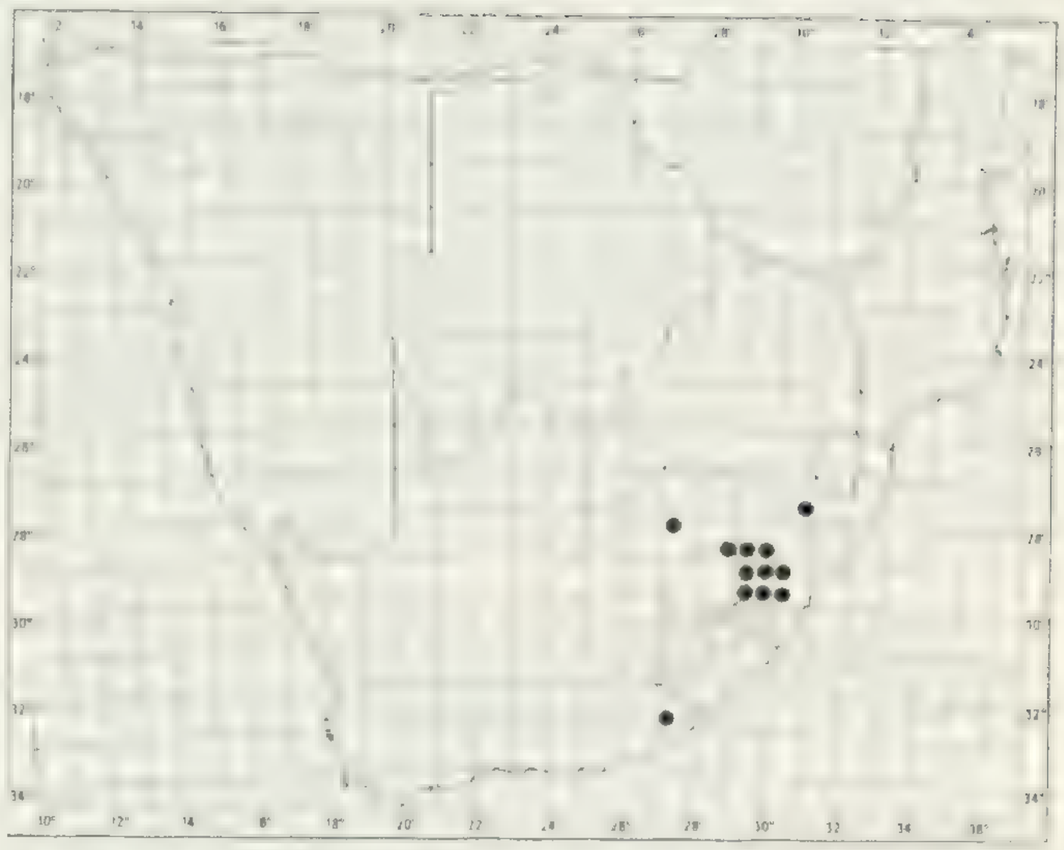


FIG. 96.—**Mielichhoferia bryoides** (1–11): **1.** habit, × 1; **2.** habit, × 8; **3.** stem in cross section, × 175; **4–6.** variation in leaf shape, × 50; **7.** leaf in cross section, × 350; **8.** basal leaf cells (left side), × 175; **9.** upper laminal cells, × 700; **10.** leaf apex, × 175; **11.** part of capsule mouth showing cells, annulus and peristome, × 150. **M. subnuda** (12–20): **12.** habit, × 1; **13.** habit, × 8; **14–16.** leaves, × 45; **17.** basal leaf cells (right side), × 700; **18.** upper laminal cells, × 700; **19.** propagulum, × 175; **20.** part of capsule mouth showing cells, annulus and peristome, × 150. (1–3 & 6–10, *Harvey* s.n. (type *M. bryoides); 4, Ecklon* s.n. (type *M. ecklonii);* 5 & 11, *Wilms* s.n. (type *M. transvaaliensis)*; 12–20, *Sim* 10197).

strongly thickened and reddish. *Leaves* appressed dry, patent wet, weakly concave; broadly elliptical, ovate or shortly oblong-acute, (0,3−)0,6−1,0 mm long; apex subacute, mucronate; margins plane or occasionally recurved below, entire. *Costa* ending below apex to mucronate or rarely cuspidate; in section rounded, bulging dorsally, guide cells not differentiated, ventral cells in single row, 2−4, cells large, thin-walled, dorsal stereid band 3−4 cells thick, occasionally substereids, dorsal surface cells incrassate. *Upper laminal cells* mostly 3−6: 1, rhomboidal to elongate-rhomboidal, thin-walled, 37−83 μm long, 9−18 μm wide; basal cells quadrate to short rectangular, not differentiated in some leaves. Propagulae bud-like, axillary, 190−300 μm long.

?Dioicous. Perichaetia lateral through subperichaetial innovation, leaves ovate-lanceolate to lanceolate. *Seta* erect, 5−9 mm long, yellowish, red or red-brown; capsules ± erect to inclined, shortly pyriform or subglobose, (0,6−)1,0−1,5 mm long, yellow-brown, red or red-brown, neck short, to 0,5 mm; exothecial cells quadrate to rectangular, rhomboidal or angular, incrassate, 2−3 rows at mouth smaller, quadrate; stomata numerous on neck and lower urn, phaneropore; annulus differentiated; peristome double, frequently appearing single, exostome teeth rudimentary, short and blunt, rarely visible above annulus, endostome yellowish, rudimentary as short, smooth basal membrane at mouth, fragile, quickly broken away, occasionally with short, irregular segments; operculum convex; spores round, 16−20 μm, minutely papillose, yellow-brown. Fig. 96: 12−20.



MAP 126.— ● **Mielichhoferia subnuda**

Endemic to southern Africa, the species is collected in grasslands and shrublands, frequently at high altitude in the eastern Cape, Lesotho, Orange Free State and Natal. Map 126.

Vouchers: *Jacot Guillarmod* 284; *Magill* 4293, 4319; *Rennie & Lambert* moss no. 56; *Schelpe* 7554; *Van Rooy* 1366.

Mielichhoferia cholnokyi does not differ from this species. It is based on characters that Sim (1926) did not fully describe for *M. subnuda*, e.g. excurrent costa, pyriform capsule, operculum shape.

The specimen, *Sim* 10197, is selected as lectotype because it conforms with the protologue and is marked 'type' in Sim's hand, on the specimen.

One of the 'paralectotypes' of *Bryum argenteum* var. *rotundifolium* (*Sim* 10232) belongs here (see note under *B. cellulare*).

3. BRACHYMENIUM

Brachymenium *Schwaegr.*, Sp. Musc. Suppl. 2: 131 (1824); Broth. in Natürl. PflFam. 10: 365 (1924); Sim, Bryo. S. Afr. 317 (1926); Andrews in Grout, Moss Fl. N. Amer. 2: 207 (1935); Ochi in J. Fac. Educ. Tottori Univ. 23: 3 (1972); Gangulee, Moss. E. India 928 (1974); Scott & Stone, Moss. S. Austr. 290 (1976). Lectotype species: *B. nepalense* Hook. in Schwaegr., fide Ochi (1972).

Plants small to large, forming dense cushions or turfs, occasionally gregarious, light green and glossy or yellow-green to green or brownish green; terricolous, saxicolous or corticolous. *Stems* erect, sparsely branched, occasionally lower stem densely matted with red-brown tomentum; in section round, central strand present, inner cortical cells large, thin-walled, outer cortical cells in 1−2 rows, smaller, weakly thickened. *Leaves* ovate to elliptical or occasionally obovate, equally spaced or crowded above; margins infrequently weakly bordered, plane to erect, entire or weakly serrate near apex. *Costa* percurrent to excurrent as short or long awn; in section with weak dorsal

stereid band. *Upper laminal cells* firm, rhomboidal to oblong-rhomboidal or sometimes lax, linear-rhomboidal to fusiform; apical cells occasionally differentiated, hyaline; basal cells quadrate to rectangular, frequently distinct. Propagulae infrequent, bud-like, axillary.

Dioicous or autoicous. Perichaetia terminal but overgrown by subperichaetial innovations. *Seta* elongate, erect; capsules erect to inclined or horizontal, pyriform to cylindrical-pyriform or clavate, neck differentiated; stomata present on neck, phaneropore; annulus differentiated; peristome double, exostome teeth 16, narrowly triangular, endostome variable, consisting of a high basal membrane, segments rudimentary or well developed, cilia rudimentary or absent; operculum low, conical; calyptra cucullate, smooth, yellowish; spores large or small, greenish.

The genus *Brachymenium* contains c. 170 species found almost entirely in the tropics and temperate regions of the Southern Hemisphere. Six species occur in southern Africa; three are endemic to Africa, two are found in Africa and Asia, and the last also occurs in Australia and South America.

Vegetatively the genus is similar to *Bryum*, however the small-mouthed, narrow capsule with incomplete endostome will identify *Brachymenium*. Most southern African specimens are recognizable on vegetative characters alone, but problems may be encountered in separating sterile specimens of *B. dicranoides*, *B. leptophyllum* and *B. nepalense* from similar *Bryum* species.

1 Plants small, forming loose turfs on soil or rock, stems sparsely tomentose; spores less than 20 μm in diameter:
  2 Plants dull, dark green; upper laminal cells firm, rhomboidal to oblong-rhomboidal, mostly 25–40 μm long ..... 1. *B. dicranoides*
  2 Plants glossy, light green; upper laminal cells lax, linear-rhomboidal to fusiform, mostly 75–150 μm long ..... 2. *B. acuminatum*
1 Plants larger, mostly corticolous; spores larger than 20 μm in diameter:
  3 Plants forming dense cushions, strongly tomentose below; leaves without obvious border, costa generally long-excurrent as weakly serrate, hyaline awn:
    4 Leaf apex hyaline, serrate; spores 40–50 μm in diameter ..... 3. *B. pulchrum*
    4 Leaf apex chlorophyllous, entire to weakly serrate; spores ± 20 μm in diameter ..... 4. *B. angolense*
  3 Plants loosely caespitose or gregarious, sparsely tomentose below; marginal cells narrower and ± thickened forming weak border 1–3 cells wide; costa short excurrent, smooth:
    5 Leaf margins revolute from base to near apex; border frequently well defined at apex; endostome segments absent or rudimentary; spores ± 25 μm in diameter ..... 5. *B. nepalense*
    5 Leaf margins only reflexed; border weakly differentiated above; endostome segments well developed; spores 35–37 μm in diameter ..... 6. *B. leptophyllum*

1. **Brachymenium dicranoides** *(Hornsch.) Jaeg.* in Verh. St. Gall. naturw. Ges. 1873–74: 113 (1875); Broth, in Natürl. PflFam. 10: 366 (1924); Sim, Bryo. S. Afr. 320 (1926); Ochi in J. Fac. Educ. Tottori Univ. 23: 6 (1972). Type: Cape, Table Mountain, *Ecklon* s.n. (BM!; H).

Bryum dicranoides Hornsch. in Linnaea 15: 134 (1841).

Bryum liliputanum C. Müll. in Hedwigia 38: 66 (1899). *Brachymenium liliputanum* (C. Müll.) Broth. in Natürl. PflFam. 10: 366 (1924). Type: Cape, Cape Town, *Rehmann* 241 (PRE!).

? *Bryum neesii* C. Müll. in Hedwigia 38: 66 (1899). *Brachymenium neesii* (C. Müll.) Par., Ind. Bryol. Suppl. 39 (1900); Broth. in Natürl. PflFam. 10: 366 (1924). Type: Cape, Gnadenthal, *Breutel* s.n.

Plants small, forming turfs, yellowish green to brownish green; terricolous or occasionally saxicolous. *Stem* 2–4(–7) mm long, sparsely radiculose below; in section cortical cells in 2–3 rows. *Leaves* small, ± concave, appressed to erect dry, erect-spreading wet; ovate to ovate-lanceolate or elliptical, (0,3–)0,5–0,8 (–1,0) mm long; apex acute to acuminate, frequently cuspidate; margins generally plane, entire. *Costa* short- to long-excurrent, yellow to yellow-brown or brown, awn smooth, 0,1–0,3 mm long; in section bulging dorsally, ventral cells in single layer, large, thin-walled, dorsal stereid band 2–4 cells thick, dorsal surface cells smaller than ventral cells, incrassate. *Upper laminal cells* mostly 3–5: 1, rhomboidal to oblong-rhomboidal, (20–)25–40(–65) μm long, (5–)8–10(–13) μm wide, occasionally incrassate; marginal cells frequently rectangular, not forming distinct border; basal cells weakly differentiated, quadrate to rectangular. Propagulae infrequent, bud-like, axillary.

Perichaetial leaves ovate-lanceolate to lanceolate, costa excurrent. *Seta* 4–15 mm long, red-yellow, reddish brown or yellow-brown; capsule suberect to horizontal, cylindrical-pyriform to pyriform, (0,6–)0,8–1,6 mm long, yellowish brown or reddish brown, mouth small, neck wrinkled dry; exothecial cells irregular to subrectangular, incrassate, smaller at mouth, transversely rectangular; peristome teeth linear, 250–400 μm long, hyaline above, yellow to yellow-brown below, finely papillose, endostome fragile, basal membrane ½ height of teeth, segments linear, narrowly perforated, just shorter than teeth, cilia absent; operculum conical; spores round, 10–15 μm, yellow-brown with age, weakly papillose. Fig. 97: 1–11.

This species is known from grasslands and shrublands of eastern and southern Africa. In the flora area it is infrequently collected in the southwestern Cape. Map 127.

Vouchers: *Garside* 6272, 6548; *Magill* 6235.

This species is very similar to *Bryum bicolor* and sterile specimens of these two species are difficult to separate. In general, *B. dicranoides* is a smaller plant with shorter, narrower leaves and smaller laminal cells. The leaf margins are also plane, while in *Bryum bicolor* they tend to be reflexed or recurved below. Both species produce axillary, bud-like propagulae, but tubers have only been found on *Bryum* specimens. Specimens with sporophytes can be easily separated on capsule shape and orientation, and peristome architecture.

This species may also be confused with *Anomobryum drakensbergense* but differences in habit, leaf shape and areolation and sporophytic characters will separate the two species.

Southern African specimens treated by Ochi (1972) as *B. dicranoides* and *B. exile* (Doz. & Molk.) Bosch. & Lac. are included here. Differences in awn length and leaf shape are considered normal variation for the African species. Examination of specimens of *B. exile* from India confirms Gangulee's (1974) circumscription of that species and in the absence of any southern African specimens it is excluded from the Flora.

MAP 127.— ● **Brachymenium dicranoides**
▲ **Brachymenium angolense**

2. **Brachymenium acuminatum** *Harv.* in Hooker's Icon. Pl. 1: 19 (1836); Broth. in Natürl. PflFam. 10: 367 (1924); Ochi in J. Fac. Educ. Tottori Univ. 23: 4 (1972); Gangulee, Moss. E. India 4: 950 (1974). Type: Nepal, *Wallich* s.n. (BM!).

Brachymenium borgenianum Hampe in Linnaea 38: 211 (1874); Broth. in Natürl. PflFam. 10: 367 (1924); Sim, Bryo. S. Afr. 320 (1926). Type: Madagascar, *Borgen* sub1.

Mielichhoferia squarrulosa C. Müll. in Hedwigia 38: 64 (1899). Type: Cape, Cape Town, *Rehmann* 210 (BM!).

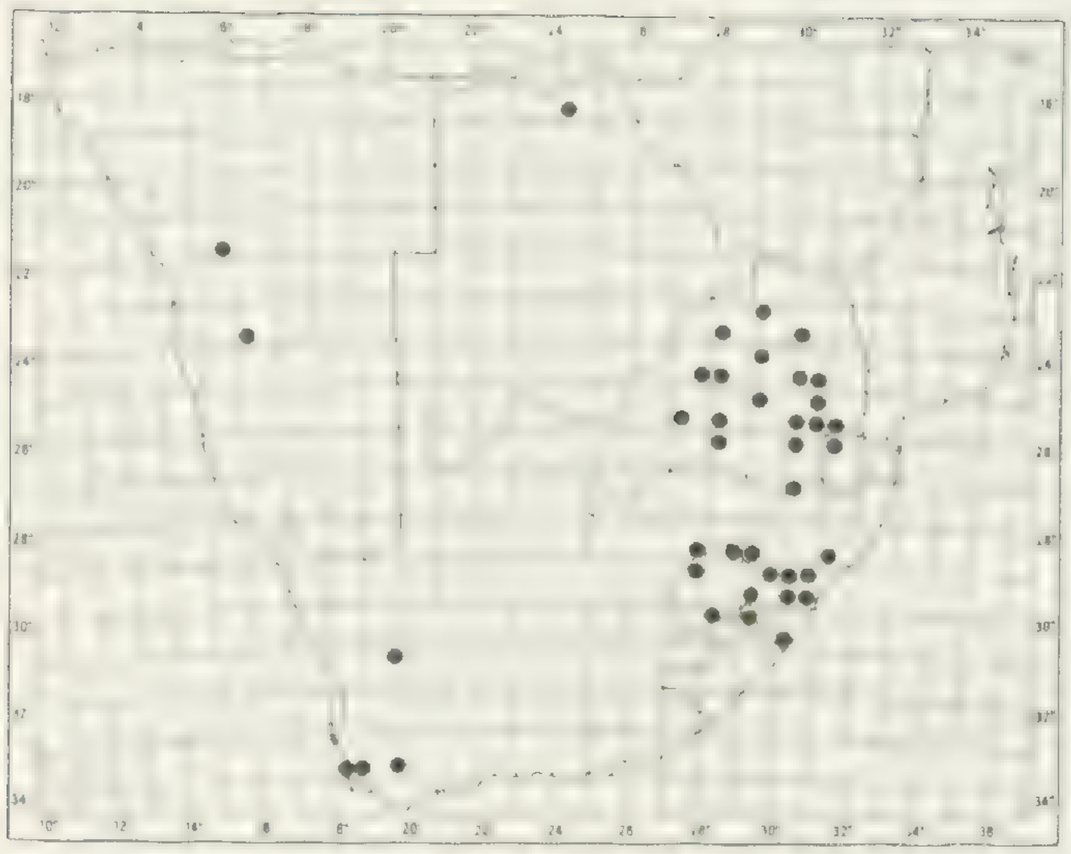
Bryum pallidojulaceum C. Müll. in Hedwigia 38: 67 (1899); *Brachymenium pallidojulaceum* (C. Müll.) Par., Ind. Bryol. Suppl. 39 (1900); Broth. in Natürl. PflFam. 10: 367 (1924). Type: Transvaal, Lake Chriss, *Wilms* s.n., Apr. 1885 (G, holo.!).

Brachymenium lonchopus P. Varde in Arch. Bot. 1: 57 (1928). Type: Rep. Congo, Oubangui, Bambari, *Tisserant* s.n. (PC, holo.).

Plants small, forming loose turfs, light green to yellowish green, glossy; terricolous. Stems (2–)5–10 mm long, sparsely radiculose below; in section cortical cells in 2–4 rows. *Leaves* erect-appressed, little altered dry, concave; ovate to ovate-acuminate or ovate-lanceolate, 0,5–0,8 mm long; apex acute to acuminate; base flat, not concave; margins erect, entire. *Costa* short-excurrent, mucro 0,1–0,2 mm long; in section subround, ventral cells 2, large, thin-walled, dorsal substereid band 2 cells thick, dorsal surface cells undifferentiated. *Upper laminal cells* mostly 6–10: 1, fusiform to linear-rhomboidal, ± sinuolate, (50–)75–150 μm long, 12–18 μm wide, dorsal surface weakly thickened; basal cells generally distinct, quadrate to short-rectangular, 1–2: 1, thin-walled.

Perichaetial leaves triangular, ± 1 mm long. *Seta* (6–)10–15(–22) mm long, yellowish; capsule suberect to inclined or almost horizontal, clavate to cylindrical-pyriform or occasionally smaller and pyriform, 2,5–3,5 mm long, yellowish, neck sulcate, to 1 mm long; exothecial cells subrectangular, walls ± wavy, 1–2 rows of transversely rectangular cells at mouth; *peristome* teeth 250–300 μm long, endostome with basal membrane 175–200 μm high, segments rudimentary; spores round, 16–18 μm, green, weakly papillose. Fig. 97: 12–21.

FIG. 97.—**Brachymenium dicranoides** (1–11): **1.** habit, × 1; **2.** habit, × 5; **3.** stem in cross section, × 175; **4.** rhizoid, × 350; **5.** leaves, × 70; **6.** leaf in proximal cross section, × 350; **7.** basal leaf cells (right side), × 175; **8.** leaf apex (left side), × 175; **9.** perichaetial leaf, × 70; **10.** part of capsule mouth showing cells and peristome, × 175; **11.** spores, × 700. **B. acuminatum** (12–21): **12.** habit, × 1; **13.** habit, × 5; **14** & **15.** leaves, × 70; **16.** leaf in proximal cross section, × 350; **17.** basal leaf cells (left side), × 175; **18.** leaf apex, × 350; **19.** perichaetial leaf, × 70; **20.** sporophyte, × 5; **21.** part of capsule mouth showing cells, peristome and spores, × 175. (1–3 & 6, *Magill* 6235; 4, 5, 7–9 & 11, *Garside* 6272; 10, *Magill* 6548; 12, 13, 18, 20 & 21, *Garside* 6608; 14, 15 & 17, *Brenan* M2786; 16, *Brenan* M3254; 19, *Wager* PRE-CH1161).



MAP 128.— ● **Brachymenium acuminatum**

Brachymenium acuminatum has been reported from eastern and southern Africa, South America, India, southeast Asia and Australia. In southern Africa the species is found in grasslands and woodlands of the northern, central, southern and eastern Transvaal, Swaziland, Natal and Lesotho. A few specimens have also been collected in the northwestern and southwestern Cape, eastern Orange Free State, central South West Africa/Namibia and Botswana. Map 128.

Vouchers: *Brenan* M2786; *Cholnoky* 315, 574; *Garside* 6608; *Magill* 3424, 3832; *Oliver* 7162; *Pearson* 9849; *Van Rooy* 995.

The glossy, light green, concave leaves, with lax, elongate upper leaf cells and generally strongly differentiated basal cells will separate *B. acuminatum* from other species of the genus.

Although the leaf is generally concave, above the base, when cut in cross-section the entire lamina is broadly recurved. This is apparently due to a slight thickening of the dorsal cell facies.

3. **Brachymenium pulchrum** *Hook.* in Hooker, bot. Misc. 1: 136 (1829); Broth. in Natürl. PflFam. 10: 367 (1924); Sim, Bryo. S. Afr. 318 (1926); Ochi in J. Fac. Educ. Tottori Univ. 23: 12 (1972). Type: Cape, Swellendam, *Mundt* s.n. (BM).

Brachymenium julaceum Hornsch. in Linnaea 15: 133 (1841); Broth. in Natürl. PflFam. 10: 367 (1924). *Bryum koratranum* C. Müll., Syn. Musc. 1: 324 (1848) *Brachymenium koratranum* (C. Müll.) C. Müll. in Rehmann, Musci Austr. Afr. no. 218 (1875) nom. illeg.; Dixon in Trans. R. Soc. S. Afr. 8: 200 (1920). Type: Cape, Outniqualand, Koratra, *Drège* s.n.

Plants medium-sized to large, forming dense cushions, light green to yellow-green, ± glossy, red-brown below; corticolous. *Stems* (5–)10–35 mm long, irregularly branched, ± julaceous, lower stem densely matted with red-brown tomentum; in section cortical cells in 6–8 rows. *Leaves* crowded, weakly concave, appressed with reflexed awns wet or dry; ovate to oval, 0,8–1,2 mm long; apex acute, hyaline; margins plane to erect, serrate at apex. *Costa* short- to long-excurrent, awn hyaline, sparsely toothed, (0,2–)0,5–1,0 mm long; in section round, ventral cells 2, in single layer, exposed walls very thin, inner walls thickened, dorsal stereid band 2–3 cells thick, dorsal surface cells undifferentiated or occasionally substereids. *Upper laminal cells* mostly 3–5: 1, oblong-rhomboidal to fusiform, ± thickened, somewhat flexuose, (75–) 87–100 (–125) μm long, 20–25 μm wide; marginal cells above mid-leaf becoming narrowly fusiform, hyaline and strongly thickened, several cells wide at apex; basal cells quadrate, forming distinct group.

Perichaetial leaves ovate-lanceolate, to 2 mm long. *Seta* 10–25 mm long, brownish; capsule erect to inclined, pyriform to cylindrical-pyriform, 3–4 mm long, yellow-brown, neck differentiated, 1,0–1,5 mm long; exothecial cells rectangular to rhomboidal, thin-walled, 1–2 rows at mouth smaller, quadrate; *peristome* teeth linear, 300 μm high, strongly reflexed against capsule wall when dry, endostome consisting of a high basal membrane, to 200 μm high; operculum low-conic; calyptra cucullate, smooth, 1,7 mm long, yellowish; spores round, 40–50 μm, green, essentially smooth. Fig. 98: 1–8.

This species is known from eastern and southern Africa, Madagascar and India. In southern Africa it is found on bark in woodlands and forests of the northern and eastern Transvaal, Swaziland, Zululand, Natal, Transkei and the eastern and southern Cape. Map 129.

MAP 129.— ● **Brachymenium pulchrum**

Vouchers: *Crosby & Crosby* 7656, 7827; *De Winter* 9378; *Hilliard & Burtt* 10083; *Kemp* 851; *Kluge* 1038; *Magill* 3747, 5500, 5993; *Rankin* 25; *Schelpe* 7553, 7867; *Smook* 1419a; *Van Rooy* 274, 2312; *Von Breitenbach* 111, 403.

Brachymenium pulchrum forms large, compact cushions on tree trunks and branches. The cushions are held together by a copious growth of red-brown tomentum. Exposed leaves at the top of stems are generally ± glossy with costa excurrent as a hyaline awn. The generally strongly differentiated apical leaf cells will also help to identify the species.

The closely related species, *B. angolense* could be confused with *B. pulchrum*, however it is somewhat smaller, and lacks the differentiated apical leaf cells (see note there).

4. **Brachymenium angolense** (*Welw. & Duby) Jaeg.* in Verh. St Gall. naturw. Ges. 1873–74: 117 (1875); Broth. in Natürl. PflFam. 10: 368 (1924); Ochi in J. Fac. Educ. Tottori Univ. 23: 11 (1972). Type: Angola, Huilla, *Welwitsch* 26 (G; H).

Bryum angolense Welw. & Duby in Mém. Soc. Phys. Hist. nat. Genève 21: 219 (1870).

Bryum campylotrichum C. Müll. in Hedwigia 38: 65 (1899). *Brachymenium campylotrichum* (C. Müll.) Broth. in Natürl. PflFam. 1: 558 (1903); 10: 367 (1924); Sim, Bryo. S. Afr. 318 (1926). Type: Transvaal, Drakensberg, *Wilms* s.n., 1884 (G).

Plants small to medium-sized, forming cushions, light green to yellow-green, ± glossy; corticolous. *Stems* (2–)5–10 mm long, densely matted below with red-brown tomentum; in section cortical cells in 4–5 rows. *Leaves* crowded, weakly concave, appressed with flexuose awns wet or dry; ovate to oval, 0,7–1,0(1,4) mm long; apex acute, chlorophyllous; margins plane, entire to weakly serrate at apex. *Costa* long-excurrent, awn hyaline, weakly toothed, 0,6–0,8 mm long; in section bulging dorsally, ventral cells 2, in single layer, large, thin-walled, dorsal stereid band 4–5 cells thick, frequently with hydroids below ventral cells, dorsal surface cells substereids or incrassate. *Upper laminal cells* mostly 3–4: 1, oblong-hexagonal to oblong-rhomboidal, thin-walled, 50–62(–75) μm long, 15–20(–25) μm wide; marginal cells smaller, rectangular to quadrate above, weakly thickened, chlorophyllous; basal cells moderately differentiated, rectangular to quadrate. Propagulae bud-like, axillary or on tomentum.

Sporophyte not known from southern Africa. Fig. 98: 9–15.

This species is known from woodlands and forests of eastern, central and southern Africa. In the Flora area *B. angolense* has been infrequently collected in dry forests of the northern and eastern Transvaal, Natal and the Caprivi Strip of South West Africa/Namibia. Map 127.

Vouchers: *Magill* 3158; *Symons* 10198; *Vahrmeijer* 119; *Wager* 253.

This species is very closely related to *B. pulchrum*. Because sporophytes are not known from the Flora area the two species are separated by size, development of apical leaf cells and upper laminal cell length. Spore size has also been reported (Ochi, 1972) useful in separating the species.

5. **Brachymenium nepalense** *Hook.* in Schwaegr., Sp. Musc. Suppl. 2: 131 (1824); Broth. in Natürl. PflFam. 10: 369 (1924); Ochi in J. Fac. Educ. Tottori Univ. 23: 32 (1972); Gangulee, Moss. E. India 4: 937 (1974). Type: Nepal, *Hooker* s.n.

Plants medium-sized, loosely caespitose or gregarious, green to yellow-green; corticolous. *Stems* 5–10 mm long, sparsely radiculose below; in section cortical cells in 4–6 rows. *Leaves* crowded and larger above, ± comose, spirally twisted around stem when dry, erect-spreading wet; oblong to elliptical or obovate, 1,5–2,2 mm long; apex obtuse, cuspidate; margins narrowly revolute from base to near apex, weakly serrate at apex. *Costa* short-excurrent; in section round, guide cells 2, small, ventral cells 2, in single layer, similar to guide cells, dorsal stereid band strong, 4 cells thick, with hydroids present below guide cells, dorsal surface cells similar to ventral surface cells, frequently thickened. *Upper laminal cells* mostly

FIG. 98.—**Brachymenium pulchrum** (1–8): **1.** habit, × 1; **2.** habit, × 3,5; **3.** leaf, × 35; **4.** part of leaf in cross section, × 350; **5.** basal leaf cells (left side), × 70; **6.** upper laminal cells (left side), × 175; **7.** capsule, × 8,5; **8.** part of capsule mouth showing cells and peristome, × 88. **B. angolense** (9–15): **9.** habit, × 1; **10.** habit, × 3,5; **11.** leaf, × 35; **12.** leaf in cross section, × 175; **13.** basal leaf cells (left side), × 175; **14.** upper laminal cells, × 175; **15.** propagula, × 70. **B. nepalense** (16–22): **16.** habit, × 1; **17.** habit, × 3,5; **18.** leaf, × 18; **19.** leaf in cross section, × 175; **20.** basal leaf cells (right side), × 175; **21.** upper laminal cells (left side), × 175; **22.** part of capsule mouth showing cells, peristome and spore, × 117. **B. leptophyllum** (23–30): **23.** habit, × 1; **24.** habit, × 3,5; **25.** leaf, × 35; **26.** leaf in cross section, × 175; **27.** basal leaf cells (left side), × 175; **28.** upper laminal cells (left side), × 175; **29.** capsule, × 5; **30.** part of capsule mouth showing cells, peristome and spore, × 88. (1, 2, 4 & 7, *Kemp* 851; 3, *Von Breitenbach* 183; 5, *Schelpe* 7934; 6, *Kemp* 1514; 8, *Smook* 2604; 9, 10, 12 & 15, *Magill* 3300; 11, 13 & 14, *Magill* 3157; 16 & 18, *Crosby & Crosby* 7657; 17 & 22, *Von Breitenbach* 143; 19, *Rehmann* 560; 20 & 21, *Magill* 4813; 23, 25, 26, 27 & 29, *Kluge* 1041A; 25, *Sim* 10196; 28 & 30, *Sim* 8823).

MAP 130.— ● **Brachymenium nepalense**
▲ **Brachymenium leptophyllum**

2–3: 1, oblong-hexagonal, 37–50 μm long, 15–20 μm wide, thin-walled, weakly pitted; marginal cells elongate and thickened, in 2–3 rows forming weak border, generally not visible because of revolute margins; basal cells quadrate to rectangular, 1–2: 1, thin-walled, faintly reddish.

Perichaetial leaves triangular, smaller than vegetative leaves. *Seta* 20 mm long, reddish yellow; capsule erect, cylindrical-pyriform, 2,5–4,0 mm long, yellow-brown, mouth reddish, neck sulcate, 1,0–1,5 mm long; exothecial cells rectangular, weakly thickened, smaller at mouth; *peristome* teeth narrowly triangular, ± 300 μm high; endostome with high basal membrane, segments absent; operculum conical; spores round, 25 μm, green, papillose. Fig. 98: 16–22.

The species has been reported from Japan to southeast Asia, New Guinea, India, central and southern Africa, Madagascar and Mauritius. In the Flora area the species has been rarely collected in the forests of the eastern and northern Transvaal and Natal. Map 130.

Vouchers: *Crosby & Crosby* 7657; *Magill* 4813; *Von Breitenbach* 1410.

This species is near the east African species *B. rigidum* Broth. & Par. but differs in having the segments of the endostome rudimentary or absent and more narrowly revolute leaf margins. It is also related to *B. leptophyllum*, the two species differ primarily in the curvature of the leaf margin and strength of the border.

Sterile specimens of *B. nepalense* could be mistaken for larger species of *Bryum*, for example *Bryum torquescens*, but specimens can usually be separated on leaf shape and curvature of the leaf margins.

6. **Brachymenium leptophyllum** *(C. Müll.) Jaeg.* in Verh. St Gall. naturw. Ges. 1873–74: 111 (1875); Broth. in Natürl. PflFam. 10: 369 (1924); Ochi in J. Fac. Educ. Tottori Univ. 23: 20 (1972). Lectotype: Ethiopia, *Schimper* 451 (H), fide Ochi (1972).

Bryum leptophyllum Bruch & Schimp. ex C. Müll., Syn. Musc. 1: 273 (1848).

Brachymenium variable Dix. in Smithson. misc. Collns 69 (8): 2 (1918); Broth. in Natürl. PflFam. 10: 369 (1924); Sim, Bryo. S. Afr. 319 (1926). Type: Uganda, Namonyungi, *Dümmer* 2577 (PRE!).

Plants medium-sized, loosely caespitose or gregarious, green, ± glossy; corticolous or occasionally terricolous. *Stems* 2–5 mm long, radiculose below; in section cortical cells in 4–6 rows. *Leaves* appressed and spirally twisted around stem dry, spreading wet; elliptical, 1,0–1,8 mm long, apex acute, fragile, mucronate; margins reflexed from base to near apex, entire to weakly serrate at apex. *Costa* short-excurrent, mucro smooth, 0,1–0,5 mm long; in section bulging dorsally, guide cells 2, ventral surface cells 2, thin-walled, dorsal stereid band 3 cells thick, reddish, with hydroids below guide cells, dorsal surface cells weakly differentiated but larger and thin-walled laterally. *Upper laminal cells* mostly 2–3: 1, oblong-hexagonal, (35–) 50–62 (–75) μm long, 16–20 μm wide, thin-walled; marginal cells narrower and slightly thickened, forming very weak border, 1 (–2) cells wide; basal cells short rectangular, 2–3: 1.

Perichaetial leaves ± triangular, smaller than vegetative leaves. *Seta* 8–14 mm long, yellow-brown; capsule suberect to horizontal, pyriform to clavate, 2,5–3,0 mm long, yellowish to brownish, neck sunken, to 1 mm long; exothecial cells irregular with wavy walls, at mouth regular and quadrate; *peristome* teeth narrowly lanceolate, 350 μm high, endostome with high basal membrane, segments as high as teeth, cilia rudimentary; operculum short-conical, reddish; spores round, 33–37 μm, brownish, papillose. Fig. 98: 23–30.

Brachymenium leptophyllum is known from central, eastern and southern Africa. In the Flora area the species has been infrequently collected in forests of Natal and the eastern Transvaal. Map 130.

Vouchers: *Kluge* 1041a; *Sim* 10196; *Smook* 1414.

The species is related to *B. rigidum* and *B. nepalense* but is distinct in its smaller size, weak leaf border and entire, reflexed margins and frequently eroded leaf apex. When sterile the species could be mistaken for species of *Bryum*, especially *Bryum capillare* and *B. torquescens*.

4. POHLIA

Pohlia *Hedw.*, Sp. Musc. 171 (1801); Broth. in Natürl. PflFam. 1: 546 (1903); Andrews in Grout, Moss Fl. N. Amer. 2: 188 (1935); Sainsb., N. Zeal. Mosses 257 (1955); Gangulee, Moss. E. India 4: 906 (1974); Scott & Stone, Moss. S. Austr. 299 (1976); Smith, Moss Fl. Brit. Irel. 363 (1978). Type species: *P. elongata* Hedw.

Webera Hedw., Sp. Musc. 168 (1801), nom. illeg.; Broth. in Natürl. PflFam. 10: 357 (1924); Sim, Bryo. S. Afr. 321 (1926). Type species: not designated.

Plants small to large, caespitose, occasionally gregarious, green to yellow-green or light green, occasionally with metallic lustre; terricolous. *Stems* erect, generally simple, tomentum sparse; in section angular, central strand large, inner cortical cells in 3–5 rows, large and thin-walled, slightly smaller and weakly thickened towards outside, outer cortical cells in 1–2 rows, stereids or substereids, reddish. *Leaves* ovate to ovate-lanceolate, becoming longer and narrower toward apex, forming comal tuft; margins unbordered, plane to recurved, entire to denticulate. *Costa* percurrent to ending below apex; in section dorsal stereid band weak. *Upper laminal cells* elongate-rhomboidal to fusiform or linear-rhomboidal, smooth, becoming slightly broader and shorter toward base. Propagulae infrequent, axillary.

Dioicous or variably monoicous. Perichaetia terminal on main stem, leaves similar to leaves of comal tuft. *Seta* elongate, flexuose; capsule nearly erect to inclined or horizontal, infrequently pendulous, pyriform to cylindrical-pyriform, neck long or short; peristome double, exostome teeth 16, endostome segments on basal membrane, cilia present, rudimentary or occasionally absent; operculum short-conical; calyptra small, deciduous; spores subround, finely papillose.

A genus of c. 115 species, *Pohlia* is found throughout the world, but its species are concentrated in the Northern Hemisphere. Three of the species found in southern Africa are very widespread in their distributions and have been reported from every continent. The fourth, *P. baronii* is presently known only from southern Africa and Madagascar; however, it is closely related to the widespread Northern Hemisphere, gemmae-producing, species complex of Section *Pohliella*.

Pohlia is similar in many respects to *Mielichhoferia* and specimens have been frequently confused, see note under *Mielichhoferia*.

1 Leaf base decurrent; propagulae present in leaf axils ..... 1. *P. baronii*
1 Leaf base not decurrent; propagulae absent or rarely in small numbers:
  2 Leaves below comul tufts broadly lanceolate; costa generally ending well below apex; plants with metallic lustre ..... 2. *P. cruda*
  2 Leaves below comal tufts narrower, ovate-lanceolate to lanceolate; costa percurrent; plants without distinct metallic lustre:
    3 Capsules ± curved, inclined to horizontal, cylindrical-pyriform, neck as long as urn; cilia rudimentary or absent ..... 3. *P. elongata*
    3 Capsules symmetrical, pendent, pyriform, neck short; cilia well developed ..... 4. *P. nutans*

1. **Pohlia baronii** *Wijk & Marg.* in Taxon 10: 25 (1961). Type: Madagascar, Betsileo, *Besson* s.n., Musci Madagasc. no. 30 (PC!).

Webera decurrens Ren. & Card. in Revue Bot. 9: 396 (1891). *Webera annotina* (Hedw.) Bruch var. *decurrens* (Ren. & Card.) Ren. & Card. in Bull. Soc. r. Bot. Belg. 32: 104 (1894); Ren., Prod. Fl. Bryol. Madagascar 163 (1897).

Plants small to medium-sized, scattered and frequently gregarious, yellow-green to light green, but with obvious red stem and lower costae; terricolous. *Stems* 5–20 mm long, ± elongated, reddish. *Leaves* ± distant, exposing red stem, incurved dry, erect-spreading wet; ovate-acuminate to ovate-lanceolate, (0,7–) 1,0–1,4 mm long, occasionally longer and narrower above; apex acuminate; margins decurrent, ± plane, entire or serrulate at apex. *Costa* percurrent to subpercurrent; in section rounded, bulging dorsally, guide cells 2, slightly thickened, ventral cells in single layer of 2–4 cells, dorsal stereid band small, of 4–6 cells, reddish, dorsal surface cells similar to ventral cells, large, weakly thickened. *Upper laminal cells* mostly 5–9: 1, elongate-rhomboidal to fusiform, 50–87×10 μm; basal cells ± rectangular. Propagulae multicellular, gemmate

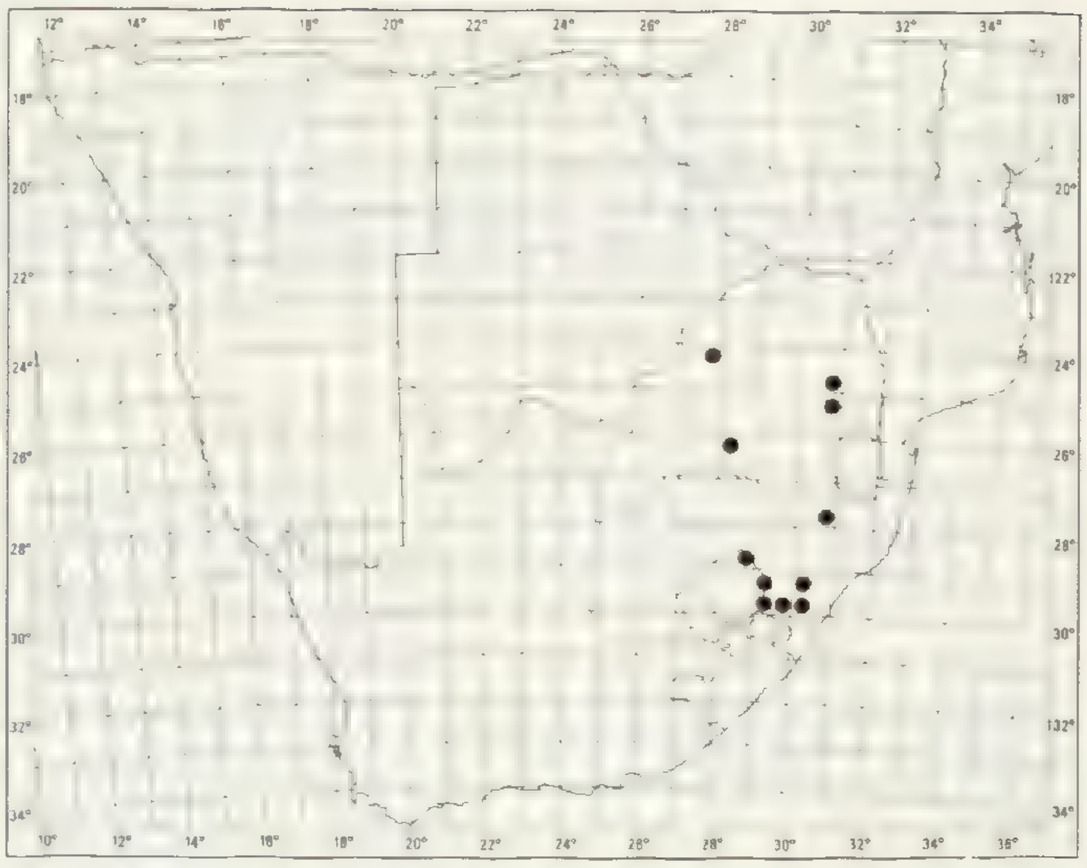
FIG. 99.—**Pohlia baronii: 1.** habit, × 1; **2.** habit, × 3; **3.** leaves, × 70; **4.** leaf in cross section, × 175; **5.** basal leaf cells (left side), × 175; **6.** leaf cells at upper right margin, × 700; **7.** leaf apex, × 175; **8 & 9.** gemmae showing variation in shape, × 145. (1–8, *Vorster* 892; 9, *Magill* 4285).

but variable in shape, ovoid to elongate-vermicular, 180–300 μm long, yellow-green to brownish, ovoid forms with several, short, incurved leaf primordia, elongated forms frequently twisted, with 1–2, frequently bent, longer leaf primordia.

Sporophyte unknown. Fig. 99.

Pohlia baronii is presently known from Madagascar and southern Africa. In the Flora area it is infrequently collected in grasslands and open shrublands of Natal, Lesotho and the eastern, southern and central Transvaal. Map 131.

Vouchers: *Cholnoky* 873; *Sim* 10231; *Stirton* 6759; *Vorster* 892, 1795.



MAP 131.— ● **Pohlia baronii**

The plants are recognized by their somewhat elongated stem and well-spaced leaves. The leaf bases are decurrent and the decurrencies are generally obvious on detached leaves.

The production of elongated bud-like propagulae in leaf axils clearly indicate the relationship of *P. baronii* to the propagulae-producing species of section *Pohliella* of the Northern Hemisphere. The plants are, in most respects, similar to *Pohlia proligera,* differing only in shorter, broader leaves and fewer propagulae. It seems probable that *P. baronii* is only a Southern Hemisphere race of *P. proligera*.

2. **Pohlia cruda** *(Hedw.) Lindb.*, Musci Scand. 18 (1879); Broth. in Natürl. PflFam. 1: 548 (1903); Andrews in Grout, Moss Fl. N. Amer. 2: 192 (1935); Flowers, Moss. Utah 343 (1973); Clarke in Br. Antarct. Surv. Bull. 37: 65 (1973); Smith, Moss Fl. Brit. Irel. 367 (1978). Type: Europe.

Mnium crudum Hedw., Sp. Musc. 189 (1801). *Webera cruda* (Hedw.) Fuernr. in Flora, Jena 12: 35 (1829); Broth. in Natürl. PflFam. 10: 359 (1924).

Webera depauperata Sim, Bryo. S. Afr. 323 (1926). *Pohlia depauperata* (Sim) Schelpe in Mem. bot. Surv. S. Afr. 43: 7 (1979). Type: Natal, Giant's Castle, *Symons* sub *Sim* 10208 (PRE, holo.!).

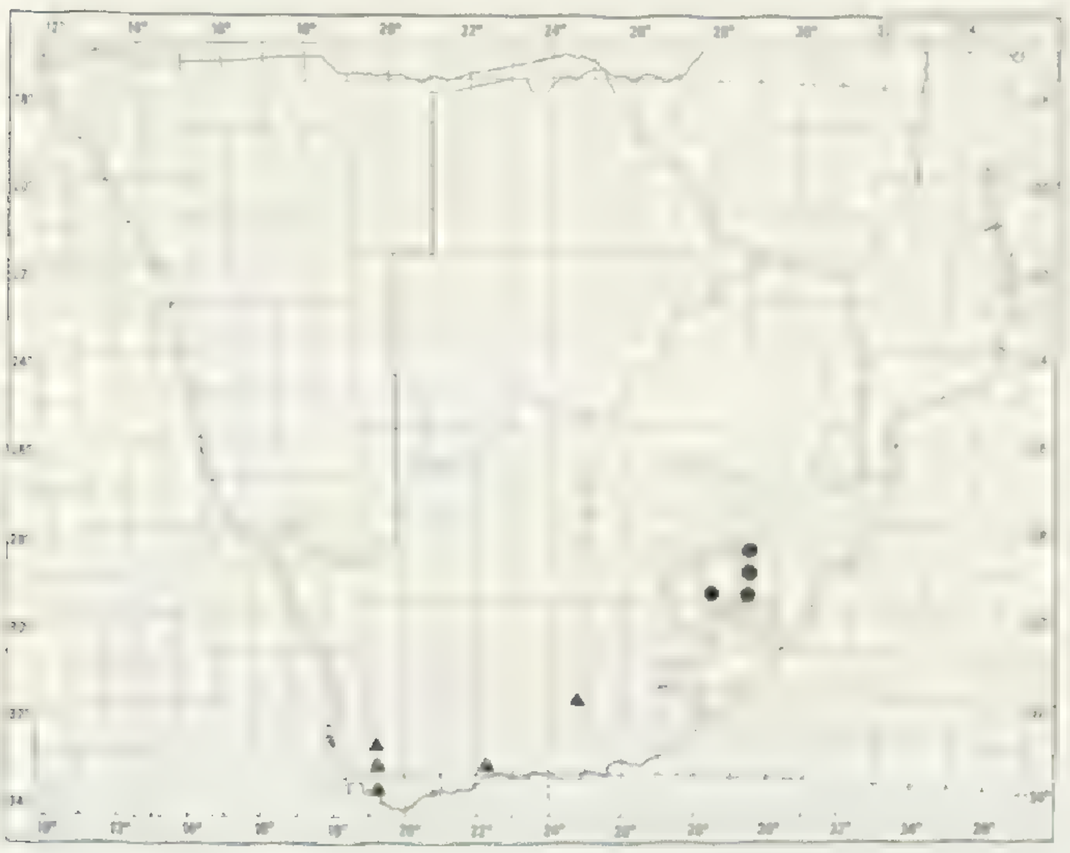
Plants large, loosely caespitose, yellow-green to hyaline green or occasionally reddish green, with distinct metallic lustre; terricolous or saxicolous. *Stems* (5–)10—30 mm long, dark red, infrequently branched, tomentum sparse, red-brown. *Leaves* larger above, forming comal tuft, erect-spreading wet, little altered dry; broadly lanceolate to elliptical, (1,2–) 1,8–3,5 mm long, abruptly narrower at stem apex, spreading; margins ± plane, minutely serrate to denticulate near apex. *Costa*

ending below apex or occasionally ± percurrent on some leaves; in section elliptical, guide cells 2, incrassate, occasionally with 1–2 ventral stereids, ventral surface cells slightly smaller than guide cells, weakly thickened, dorsal stereid band small, of 3–4 cells, generally with hydroids below guide cells, dorsal surface cells similar to ventral surface cells but more strongly thickened. *Upper laminal cells* mostly 8–14: 1, fusiform to linear-rhomboidal, vermicular, 80–150×10–12 μm; basal cells long-rectangular.

Dioicous, autoicous or paroicous, but sporophytes infrequent. Perichaetia terminal, leaves linear, to 3 mm long. *Seta* 10–15 mm long, ± flexuose, yellow-brown; capsule inclined to horizontal, elliptical, 2,0—2,5 mm long, yellow-brown, neck short, inconspicuous; exothecial cells rectangular to rhomboidal, 2–4 rows at mouth smaller and 1—2 transversely rectangular; stomata at base of urn and on neck, phaneropore; annulus differentiated; *peristome* double, exostome teeth narrowly triangular, to 0,5 mm long, finely papillose, endostome with basal membrane to ⅓ height of teeth, segments fragile, ± irregular and cleft, not as high as teeth, cilia 2–3; operculum conic-apiculate; spores rounded, 25–30 μm, finely papillose, light brown. Fig. 100: 1–10.

A widespread species, *P. cruda* is known from North, Central and South America, Europe, Asia, southern Africa, Australia, New Zealand, Antarctica and Oceania. In the Flora area, the species is restricted to the high grass-heathlands in and around Lesotho. Map 132.

Vouchers: *Esterhuysen* 21622; *Magill* 4189, 4402, 4592; *Van Rooy* 1323.



MAP 132.— ● **Pohlia cruda**
▲ **Pohlia nutans**

Pohlia cruda is unlikely to be confused with other species because of a distinct metallic lustre, light to hyaline green leaves and the dark red stem and lower costa. In addition the broad stem leaves are distinct from the longer, narrower comal leaves at the apex.

Sim's (1926) observations on the peristome of *P. depauperata* could not be verified since all available capsules had been dissected. The type specimen agrees in all other characters and in distribution to southern African specimens of *P. cruda* with complete peristomes.

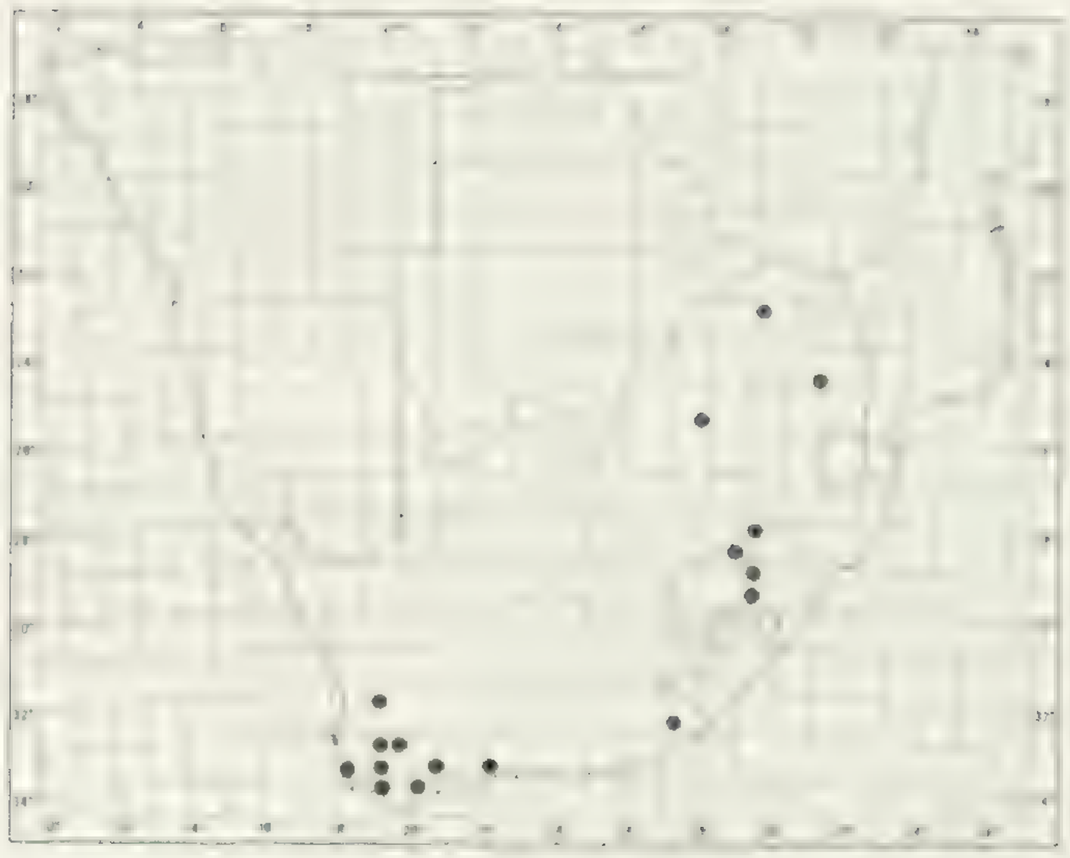
3. **Pohlia elongata** *Hedw.*, Sp. Musc. 171 (1801); Broth. in Natürl. PflFam. 1: 547 (1903); Andrews in Grout, Moss Fl. N. Amer. 2: 193 (1935); Flowers, Moss. Utah 346 (1973); Smith, Moss Fl. Brit. Irel. 364 (1978). Type: Germany.

Webera elongata (Hedw.) Schwaegr., Spec. Pl. edn 4,5: 48 (1832); Broth. in Natürl. PflFam. 10: 358 (1924).

Bryum leptoblepharon C. Müll., Syn. Musc. 1: 337 (1848). *Pohlia leptoblepharon* (C. Müll.) Broth. in Natürl. PflFam. 1: 547 (1903). *Webera leptoblepharon* (C. Müll.) Jaeg. in Verh. St Gall. naturw. Ges. 1873–74: 138 (1875); Broth. in Natürl. PflFam. 10: 359 (1924); Sim, Bryo. S. Afr. 324 (1926). Syntypes: Cape, Zwellendam, *Ecklon* s.n., Oct. 1826; Grootvaders, *Ecklon* s.n., Oct. 1826 (both BM!).

Bryum mielichhoferiacea C. Müll. in Hedwigia 38: 75 (1899). *Webera mielichhoferia* (C. Müll.) Par., Ind. Bryol. Suppl. 328 (1900); Broth. in Natürl. PflFam. 10: 359 (1924); Sim, Bryo. S. Afr. 322 (1926). *Pohlia mielichhoferia* (C. Müll.) Broth. in Natürl. PflFam. 1: 547 (1903). Type: Cape, Table Mountain, *Rehmann* s.n., Nov. 1875 (cf. no. 222, BM!; G!; vide Dix. & Gepp, 1923).

Plants small to medium-sized, loosely caespitose to gregarious, green to yellow-green; terricolous. *Stems* 5–10(–20) mm long, reddish to reddish yellow, generally simple, sparsely tomentose below. *Leaves* longer and narrower above, forming comose tuft, appressed dry, erect-spreading wet; ovate-lanceolate, 1–2 mm long, becoming linear-lanceolate, 1,7–3,5 mm long at apex, forming distinct tuft; apex acuminate; margins generally plane but reflexed medially in upper leaves, entire below, generally denticulate at apex. *Costa* subpercurrent to percurrent; in section rounded, bulging dorsally, guide cells 2–4, occasionally with 1–2 ventral stereid cells, ventral surface cells large and weakly thickened but smaller than guide cells, dorsal stereid band 3–4 cells thick, frequently with hydroids below central guide cells, dorsal surface cells similar to ventral surface cells but more strongly thickened. *Upper lamina cells* mostly 4–10: 1, oblong-rhomboidal to linear, 37–100(–175) × 8–12 μm, weakly vermicular; basal cells weakly differentiated, linear to long-rectangular at insertion, walls straight.



MAP 133.— ● **Pohlia elongata**

Autoicous. Perichaetia terminal, leaves ovate-acuminate, to 2 mm long. *Seta* erect, 10–30 mm long, yellow-brown; capsule generally ± asymmetrical, curved, inclined to horizontal, cylindrical-pyriform, 4–5 mm long, smooth, yellow-brown, neck ± distinct, mostly as long as urn; exothecial cells elongate-rhomboidal, weakly thickened, 2–3 rows at capsule mouth smaller, quadrate; stomata present on neck, phaneropore; annulus differentiated; *peristome* double, yellowish, exostome teeth narrowly triangular, finely papillose, endostome with low basal membrane, to ⅓ height of teeth, segments broad, as high as teeth, cilia rudimentary to absent; operculum conic-apiculate; spores rounded, 18–25 μm, weakly papillose, light brown. Fig. 100: 11–19.

A widespread species found in North America, Europe, Asia, Africa and Kerguelen Island. In the Flora area, *P. elongata* is collected in grasslands and open shrublands of the southwestern, southern and eastern Cape, Natal, Lesotho and the eastern, central and northern Transvaal. Map 133.

Vouchers: *Cholnoky* 914; *Edwards* 582; *Magill* 3780, 4479, 4902, 6065; *Venter* 4534.

Sporophytes are common on specimens of *P. elongata* and are important in separating specimens from other species of *Pohlia*, especially *P. nutans*. The long, inclined capsules, with the neck as long as the urn, will place specimens in *P. elongata*. The cilia of the endostome are variable, but never as well developed as in *P. nutans;* see note under that species.

4. **Pohlia nutans** *(Hedw.) Lindb.*, Musci Scand. 18 (1879); Broth. in Natürl. PflFam. 1: 548 (1903); Andrews in Grout, Moss Fl. N. Amer. 2: 194 (1935); Flowers, Moss. Utah 344 (1973); Clarke in Br. Antarct. Surv. Bull. 37: 69 (1973); Smith, Moss Fl. Brit. Irel. 367 (1978). Type: Germany.

Webera nutans Hedw., Sp. Musc. 168 (1801); Broth. in Natürl. PflFam. 10: 360 (1924); Sim, Bryo. S. Afr. 322 (1926).

?*Bryum ecklonianum* C. Müll. in Bot. Ztg 13: 752 (1855); Dixon in Trans. R. Soc. S. Afr. 8: 200 (1920); *Pohlia ecklonianum* (C. Müll.) Jaeg. in Verh. St Gall. naturw. Ges. 1873–74: 138 (1875). Type: Cape, Kleinriviersberg, Caledon district, *Ecklon* s.n., Nov. 1825.

Bryum afronutans C. Müll. in Hedwigia 38: 76 (1899). *Webera afronutans* (C. Müll.) Par., Ind. Bryol. Suppl. 327 (1900). Type: Cape, Montagu Pass, *Rehmann* s.n., Oct. 1875 (cf. no. 221, BM!, vide Dixon & Gepp, 1923).

Bryum humidulum Sull. & Lesq. in Proc. Am. Acad. Arts Sci. 4: 278 (1959). Type: Cape, nr Simonstown, *C. Wright* s.n., 29 Sept. 1853 (FH, holo.!).

Plants small to medium-sized, loosely caespitose, green to yellow-green; terricolous. *Stems* 10–30 mm high, reddish, mostly simple, sparsely tomentose below. *Leaves* larger above, forming comose tuft, erect to erect-spreading wet or dry, below ovate-lanceolate 1,3–2,5 mm long, above linear-lanceolate, 2–3 mm long; apex acuminate; margins plane to narrowly recurved, entire to denticulate at apex. *Costa* percurrent to subpercurrent; in section bulging dorsally, guide cells 2, incrassate, occasionally with 1–2 ventral stereids, ventral surface cells similar to guide cells, dorsal stereid band weak, only a few cells and hydroids below guide cells, dorsal surface cells similar to ventral cells, incrassate. *Upper laminal cells* mostly 5–8: 1, linear to elongate-hexagonal, 50–75 (–100) × 10–12 μm, frequently incrassate; basal cells rectangular.

Paroicous. Antheridia in axils of comal leaves; perichaetia terminal, leaves similar to

FIG. 100.—**Pohlia cruda** (1–10) **1.** habit, × 1. **2.** habit, × 3; **3.** part of stem in cross section, × 175; **4.** leaves, × 35; **5.** leaf from stem apex, × 35; **6.** leaf in cross section, × 175, **7.** basal leaf cells (right side), × 175; **8.** laminal cells, × 700; **9.** leaf apex, × 175; **10.** part of capsule mouth showing cells, peristome and spores, × 60 **P. elongata** (11–19): **11.** habit, × 1; **12.** habit, × 3; **13 & 14.** leaves, × 35. **15.** leaf in cross section, × 175. **16.** basal leaf cells (left side), × 175, **17.** laminal cells, × 700; **18.** leaf apex, × 175. **19.** part of capsule mouth showing cells and peristome, × 175. **P. nutans** (20–28): **20.** habit, × 1; **21.** habit, × 3; **22.** leaves, × 35. **23.** leaf in proximal cross section, × 175; **24.** leaf in distal cross section, × 175; **25.** basal leaf cells (left side), × 175; **26.** laminal cells, × 700. **27.** leaf apex, × 175; **28.** part of capsule mouth showing cells and peristome, × 100 (1–10, *Esterhuysen* 21621, 11–19, *Edwards* 582, 20–28, *Thorne* 50374)

comal leaves. *Seta* flexuose, 10–30 mm long, brownish; capsule subhorizontal to pendent, pyriform, 2 mm long, neck short; exothecial cells irregularly rectangular, thin-walled; 1–2 rows at mouth darker, transversely rectangular; stomata present on neck, phaneropore; annulus differentiated; *peristome* double, yellowish, exostome teeth narrowly triangular, finely papillose, endostome with high basal membrane, segments broad, as high as teeth, cilia well developed, 2–3, elongate; operculum convex-apiculate; spores rounded, 18–25 μm, weakly papillose, brownish. Fig. 100: 20–28.

A very widespread species, *P. nutans* is found in North and South America, Europe, Asia, Africa, Australia, New Zealand, Antarctica and Oceania. In southern Africa the species is known from the central, southern and south-western Cape. Map 132.

Vouchers: *Thorne* 50374; *Wager* 439.

A strict definition of *P. nutans* is used in the Flora. Plants placed in the species have short-pyriform capsules that are generally subhorizontal to pendent; the neck of the capsule is shorter than the urn, and the endostome cilia are well developed and as long as segments.

Variation in leaf shape and size, leaf cell length and width, and stature of plants makes separation of sterile specimens of *P. nutans* and *P. elongata* rather arbitrary.

Insufficiently Known Species

Pohlia philonotula (C. Müll.) Broth. in Natürl. PflFam. 1: 552 (1903). Basionym: *Bryum philonotula* C. Müll. in Hedwigia 38: 76 (1899). Type: Transvaal, Kuilen near Lydenburg, *Wilms* s.n., Feb. 1888, Herb. Jack. The type has not been located. The species was described sterile and generic placement is uncertain; see note in Sim (1926).

Pohlia pseudophilonotula (C. Müll.) Broth. in Natürl. PflFam. 1: 552 (1903). Basionym: *Bryum pseudophilonotula* C. Müll. in Hedwigia 38: 76 (1899). Type: Transvaal, Lake Chriss, *Wilms* s.n., Apr. 1885, Herb. Jack. The type has not been located. The species was described sterile and generic placement is uncertain; see note in Sim (1926).

Pohlia macleai (Sim) Schelpe in Mem. bot. Surv. S. Afr. 43: 7 (1979). *Webera macleai* Sim, Bryo. S. Afr. 323 (1926). Type: Cape, Rhenosterberg, *MacLea* sub *Rehmann* 548 (BM; BOL; NH!; PRE!). Sim's (1926) peristome observations could not be verified. The specimen at PRE shows only fragments of an endostome remaining and the NH specimen is sterile. In addition, gametophytically, the specimens resemble a large specimen of *Mielichhoferia bryoides* and the sporophytes of the PRE specimen are from short basal buds. Dixon in Sim (1926) reported that the 'London' specimen is a tall form of *P. elongata* with the habit of *Mniobryum albicans*. It is possible that the collection (*Rehmann* 548) was mixed and more duplicates must be examined to clarify the problem.

5. PLAGIOBRYUM

Plagiobryum *Lindb.* in Öfvers. K. VetenskAkad. Förh. 19: 606 (1863); Broth. in Natürl. PflFam. 10: 372 (1924); Andrews in Grout, Moss Fl. N. Amer. 2: 209 (1935); Gangulee, Moss. E. India 4: 952 (1974); Smith, Moss Fl. Brit. Irel. 381 (1978). Type species: *P. zierii* (Hedw.) Lindb.; fide Andrew in Grout, Moss Fl. N. Amer. 2: 209 (1935).

Plants mostly small, gregarious; terricolous. *Stems* erect, little branched; central strand small. *Leaves* imbricate, broadly ovate, concave. *Costa* generally ending below apex. *Laminal cells* lax, thin-walled.

Dioicous. *Seta* short, curved; capsule clavate; peristome double, exostome teeth shorter than segments, cilia rudimentary; operculum conic; spores large.

A genus of seven species found at high altitudes or latitudes of Europe, North America, Asia, Africa and New Zealand. This is the first report of the genus from southern Africa, where it is restricted to the afro-alpine region of the Drakensberg and the high grass-heathland of Lesotho.

The genus could be confused with the hyaline or silvery species of *Bryum*, but the distinct capsule and peristome will easily separate the two genera. Sterile specimens are most easily identified by size, leaf shape and colouration, lax leaf cells and habitat.

Plagiobryum zierii *(Hedw.) Lindb.* in Öfvers. K. VetenskAkad. Förh. 19: 606 (1863); Broth. in Natürl. PflFam. 10: 373 (1924); Andrews in Grout, Moss Fl. N. Amer. 2: 210 (1935); Nyholm, Moss Fl. Fenn. 2: 212 (1954); Gangulee, Moss. E. India 4: 953 (1974); Smith, Moss Fl. Brit. Irel. 381 (1978). Type: Europe.

Bryum zierii Hedw., Sp. Musc. 182 (1801). *Pohlia zierii* (Hedw.) Schwaegr., Spec. Pl. edn 5, 5: 76 (1830).

Plants small to medium-sized, gregarious or loosely tufted, light green to hyaline with faint reddish tint; terricolous. *Stems* 4–10 mm high, julaceous, infrequently branched, sparsely

radiculose below; in section rounded, inner cortical cells in 2−3 rows, thin-walled, hyaline, outer cortical cells in 2 rows, weakly thickened, reddish. *Leaves* imbricate wet or dry, concave; broadly ovate, 0,6−1,0 mm long, 0,5−0,7 mm wide; apex acute, hyaline; margins plane to erect, entire. *Costa* reddish, ending below apex to subpercurrent; in section bulging dorsally, ventral cells 2−3, in single layer, large, thin-walled, dorsal stereid band 3−4 cells thick, occasionally cells only weakly thickened, dorsal surface cells 3−4, slightly smaller then ventral cells. *Upper laminal cells* rhomboidal to oblong-rhomboidal, 2−4: 1, hyaline, lax, thin-walled but firmer below; upper marginal cells short-rectangular, in 1−2 rows, not forming distinct border; basal cells rectangular, 2−3: 1, thin-walled, reddish.

Dioicous. Male plants similar, perigonia terminal or lateral through innovation. Perichaetia terminal, frequently overgrown by subperichaetial innovations; leaves triangular to elliptical, 1,2−1,5 mm long, reddish to yellowish. *Seta* 6−10 mm long, stout, ± curved, yellow-brown; capsules horizontal to pendulous, clavate or gibbous, to 5 mm long, mouth oblique, neck differentiated, 1−2 mm long; exothecial cells irregularly rectangular, thickened, smaller and quadrate at mouth; stomata cryptopore, numerous on neck; annulus differentiated; *peristome* double, exostome teeth triangular, 0,3 mm long, weakly papillose, shorter than endostome, endostome segments narrow above high basal membrane, yellowish, weakly papillose, cilia rudimentary; operculum conical; spores large, rounded, 30−40 μm, yellow-brown, papillose. Fig. 101: 1−11.

MAP 134.— ● **Plagiobryum zierii**
▲ **Leptobryum pyriforme**

New to southern Africa, *P. zierii* is also known from Europe, Asia, India, northern Africa and North America. In the Flora area the species is found on soil of cliff faces or rock crevices in the grass-heathlands of Lesotho and the Drakensberg escarpment of Natal and at high altitudes in Natal. Map 134.

Vouchers: *Deall & Killick* 98a; *Esterhuysen* 26172; *Magill* 4454, 4498, 4506a; *McVean* 269124; *Van Rooy* 1325.

Specimens with sporophytes are distinctive and easily recognised. Sterile specimens may be macroscopically confused with specimens of *Bryum cellulare* or perhaps larger specimens of *B. argenteum*. The shorter, acute apex will separate this species from the east African species, *Plagiobruym piliferum* P. Varde.

6. LEPTOBRYUM

Leptobryum *(B.S.G.) Wils.*, Bryol. Brit. 219 (1855); Broth. in Natürl. PflFam. 10: 373 (1924); Sim, Bryo. S. Afr. 324 (1926); Gangulee, Moss. E. India 4: 896 (1974); Catcheside, Moss. South Austr. 246 (1980); Crum & Anderson, Moss. E. N. Amer. 1: 536 (1981). Type species: *L. pyriforme* (Hedw.) Wils.; fide Andrews in Grout, Moss Fl. N. Amer. 2: 187 (1935).

Plants mostly small, loosely caespitose; terricolous or corticolous. *Stems* erect, rarely branching; in section round, central strand large, cells thin-walled, inner cortical cells in 3−4 rows, outer cortical cells in 1−2 rows, smaller and incrassate; tubers subterranean or axillary on short rhizoids, numerous, ovoid, cells large and few. *Leaves* distant below, comose and larger above, subulate or setaceous above an ovate base. *Costa* broad, frequently filling subula, mostly subpercurrent; in section crescent-shaped, guide cells large. *Laminal cells* linear.

Synoicous. *Seta* long; capsule inclined to pendulous, pyriform; stomata phaneropore; annulus differentiated; peristome double, exostome teeth generally as long as segments, cilia 2−3, basal membrane high; operculum conic, mammillate; calyptra cucullate; spores round.

A cosmopolitan genus of 6 species. The long, narrow leaves resemble those of *Dicranella* and some other genera of the Dicranaceae but the inclined to pendulous, pyriform capsule and peristome characters place plants in Bryaceae.

Leptobryum pyriforme *(Hedw.) Wils.*, Bryol. Brit. 219 (1855); Broth. in Natürl. PflFam. 10: 374 (1924); Sim, Bryo. S. Afr. 325 (1926); Gangulee, Moss. E. India 4: 896 (1974); Catcheside, Moss. South Austr. 246 (1980); Crum & Anderson, Moss. E. N. Amer. 1: 536 (1981). Type: Europe.

Webera pyriformis Hedw., Sp. Musc. 169 (1801).

Plants small to medium-sized, loosely caespitose, green to yellow-green; terricolous or corticolous. *Stems* to 25 mm tall, rarely branching, brownish or reddish-brown or purple, occasionally radiculose below; rhizoids papillose, brownish to red or purple; tubers ovoid, numerous, subterranean or frequently axillary on short rhizoids, 120−160 μm long, cells large and few, brown or reddish brown. *Leaves* distant below, comose and larger above, erect-spreading to widely spreading, frequently flexuose; linear-lanceolate or ovate-subulate, 0,5−3,0 mm long below, 3,5−8,0 mm long above; apex setaceous or subulate; base generally ovate, frequently sheathing; margins plane, entire or denticulate, often bistratose above; border absent. *Costa* broad, frequently filling subula, subpercurrent to percurrent or aristate, ventral and dorsal superficial cells smooth to rough; in section crescent-shaped, laminal insertion medially, guide cells large, ventral stereid band absent, ventral cells in 1−2 rows, dorsal cells in 1−2 rows with scattered stereids or substereids. *Upper laminal cells* linear-rhomboidal or linear-rectangular, thin-walled, 75−125 μm long, 5−9 μm wide, mostly 10−15: 1; basal cells irregularly linear-rectangular, frequently brownish or reddish-brown below.

Synoicous. Perichaetia terminal, leaves ovate-subulate. *Seta* 12−25 mm long, yellow-brown or reddish brown; capsule inclined to pendulous, pyriform, yellowish brown or orange, frequently shiny; urn 0,7−0,9 mm long, neck generally 1 mm long, sulcate; exothecial cells irregularly rectangular to quadrate, thin-walled, 3−8 rows at mouth smaller; *peristome* double, yellowish, exostome teeth, oblong-acuminate, trabeculate, finely papillose, endostome hyaline or yellowish, segments keeled, perforated, cilia 2−3, appendiculate, basal membrane high, minutely papillose; operculum conic, mammillate; calyptra cucullate; spores round, 12,5 μm, pale, smooth or finely papilose. Fig. 101: 12−22.

This species has a cosmopolitan distribution. In southern Africa *Leptobryum pyriforme* is infrequently collected on bark or soil in the southern Cape and Natal. Map 134.

Vouchers: *Edwards* PRE-CH10396; *Schoeman 18; Sim* 10205; *Wager* 279, 435.

Leptobryum pyriforme will be recognized by the long subulate leaves above ovate bases, the broad costa with large guide cells in section, the linear-rectangular laminal cells, the ovoid tubers with large cells and the wide-mouthed capsule.

7. ANOMOBRYUM

Anomobryum *Schimp.* in Syn. Musc. 382 (1860); Broth. in Natürl. PflFam. 10: 371 (1924); Sim, Bryo. S. Afr. 325 (1926); Gangulee, Moss. E. India 4: 954 (1974); Smith, Moss Fl. Brit. Irel. 383 (1978). Type species: *A. julaceum* (Brid.) Schimp.

Plants small to medium-sized, caespitose, mostly yellowish green, frequently glossy; terricolous or saxicolous. *Stems* erect, frequently julaceous, branched; in section with central strand; rhizoids densely papillose. *Leaves* evenly spaced along stem, about equal in size, imbricate, concave, mostly ovate; margins generally plane, entire to denticulate above; border absent. *Costa* ending below apex to mucronate. *Upper laminal cells* rhomboidal to linear-vermicular, frequently incrassate; basal cells broader, quadrate to rectangular.

FIG. 101.—**Plagiobryum zierii** (1−11): **1.** habit, × 1; **2.** habit, × 3,5; **3.** leaves, × 70; **4.** leaf in cross section, × 175; **5.** basal leaf cells (right side), × 175; **6.** laminal cells, × 600; **7.** leaf apex, × 175; **8.** perichaetial leaf, × 70; **9.** sporophyte, × 3,5; **10.** part of capsule mouth showing cells, annulus and peristome, × 140; **11.** spore, × 350. **Leptobryum pyriforme** (12−22): **12.** habit, × 1; **13.** habit, × 3,5; **14.** stem in cross section, × 175; **15.** leaf, × 35; **16.** leaf in proximal cross section, × 260; **17.** leaf in distal cross section, × 260; **18.** basal leaf cells (right side), × 175; **19.** upper leaf lamina, × 175; **20.** tuber, × 175; **21.** sporophyte, × 3,5; **22.** part of capsule mouth showing cells and peristome, × 70. (1–7, *Magill* 4506a; 8−11, *Deall & Killick* 98a; 12−15, 21 & 22, *Edwards* PRE-CH10396; 16−18, *Wager* 279; 19 & 20, *Sim* 10205).

Dioicous. Perichaetia terminal but quickly overgrown by elongation of subperichaetial innovations. *Seta* elongate; capsule inclined to pendulous, generally pyriform, neck wrinkled when dry; stomata phaneropore; annulus differentiated; peristome double, exostome teeth trabeculate, endostome segments keeled, broadly perforated, cilia rudimentary or 2–3, basal membrane high; operculum conic, blunt to apiculate; calyptra cucullate; spores round.

The c. 60 species of *Anomobryum* occur in tropical and temperate regions world-wide. The sporophytic and many gametophytic characters of *Anomobryum* are similar to those of *Bryum* and the genus has occasionally been placed in synonymy with *Bryum* or even *Pohlia*. *Anomobryum* is recognized here as a separate genus on the basis of its distinct habit and leaf areolation.

1 Costa ending below apex; margins denticulate above; upper laminal cells linear-rhomboidal to linear-vermicular, 50–140 μm long ..... 1. *A. filiforme*

1 Costa percurrent; margins entire; upper laminal cells rhomboidal, occasionally vermicular, 35–63(–85) μm long ..... 2. *A. drakensbergense*

1. **Anomobryum filiforme** *(Dicks.) Solms* in Rabenh., Bryoth. Eur. 25: 331 (1873); Broth. in Natürl. PflFam. 10: 372 (1924); Gangulee, Moss. E. India 4: 958 (1974); Smith, Moss Fl. Brit. Irel. 383 (1978). Type: Europe.

Bryum filiforme Dicks., Pl. Crypt. Brit. 4: 16 (1801).

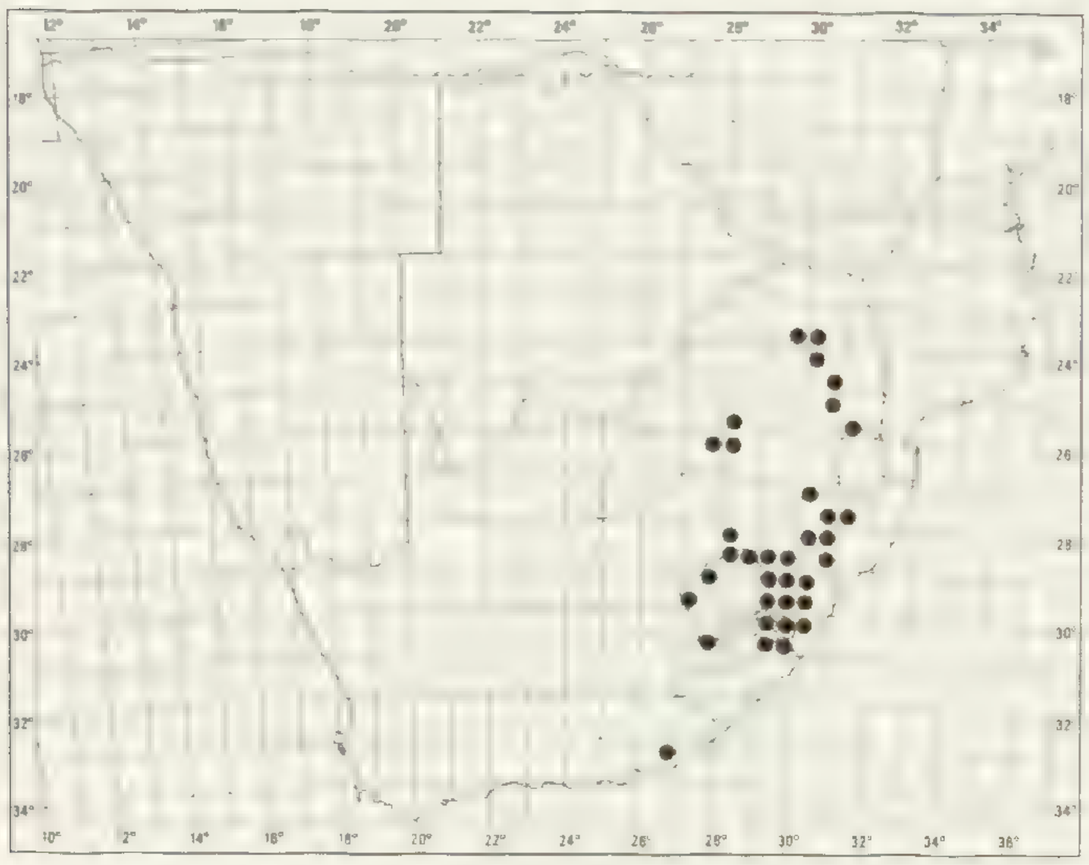
Bryum promontorii C. Müll. in Hedwigia 38: 69 (1899), fide Ochi in J. Fac. Educ. Tottori Univ. 23: 38 (1972). *Anomobryum promontorii* (C. Müll.) Dix. in Trans. R. Soc. S. Afr. 8: 201 (1920); Broth. in Natürl. PflFam. 10: 372 (1924); Sim, Bryo. S. Afr. 325 (1926). Syntypes: Orange Free State, Witteberg Mtn above Kadziberg. *Rehmann* 214 (540) (PRE!); Transvaal, Lydenburg, Apr. 1887, *Wilms* in Herb. Jack.

Plants small to medium-sized, caespitose, olivaceous or green or mostly yellowish green to yellow above, olivaceous or brownish to reddish brown below, generally glossy; terricolous or saxicolous. *Stems* to 37 mm tall, julaceous, brown to red-brown, branching by forks or subperichaetial innovations, tomentose below; in section round, central strand of thin-walled cells present, inner cortex 2–3 cells wide, thin-walled, outer cortex 1–2 cells wide, incrassate; rhizoids densely papillose, brownish to red-brown. *Leaves* evenly spaced along stem, about equal in size, imbricate, concave, ovate or oblong-acute, (0,5–)0,9–1,6 mm long; apex acute or obtuse, apiculate, margins plane or occasionally recurved below, denticulate above; border absent. *Costa* ending below apex, frequently red below; in section ovoid, ventrally concave, laminal insertion median, guide cells frequently exposed ventrally, dorsal stereid band strong, dorsal surface cells incrassate. *Upper laminal cells* linear-rhomboidal or linear-vermicular, incrassate, occasionally pitted, (37–)50–140 μm long, 7–12 μm wide; basal laminal cells frequently reddish, irregularly rectangular.

Dioicous. Perichaetia terminal but quickly overgrown by innovations, leaves ovate-lanceolate or lanceolate. *Seta* 13–20 mm long, yellowish red or reddish brown; capsule inclined to pendulous, generally pyriform, yellowish brown or reddish brown; urn 0,8–1,1 mm long, contracted below mouth when dry, neck 0,4–1,0 mm long, wrinkled when dry; exothecial cells irregularly rectangular to quadrate, incrassate, smaller at mouth; stomata present on neck, phaneropore; *peristome* teeth yellow to yellow-brown, orange below, hyaline above, narrowly oblong-acuminate, trabeculate, finely papillose, endostome segments keeled, broadly perforated, cilia 2–3, appendiculate, basal membrane high, hyaline to yellowish above, yellow below, finely papillose; operculum conic, apiculate; calyptra cucullate; spores 13–16 μm, finely papillose. Fig. 102: 1–11.

This widely distributed species is known from Europe, Asia, Oceania, Iceland, North and South America and Africa. In southern Africa *A. filiforme* is frequently collected

FIG. 102.—**Anomobryum filiforme** (1–11): **1.** habit, × 1; **2.** habit, × 1; **3.** habit, × 10; **4.** stem in cross section, × 175; **5.** leaves, × 40; **6.** leaf in proximal cross section, × 420; **7.** leaf in distal cross section, × 420; **8.** basal leaf cells (left side), × 175; **9.** leaf apex, × 175; **10.** part of capsule mouth showing cells and peristome, × 175; **11.** spore, × 700. **A. drakensbergense** (12–25): **12.** habit, × 1; **13.** habit, × 3; **14.** stem in cross section, × 175; **15.** rhizoid, × 350; **16.** leaves, × 35; **17.** leaf in proximal cross section, × 350; **18.** basal leaf cells (left side), × 175; **19.** upper laminal cells, × 350; **20.** leaf apex (left side), × 175; **21.** perichaetial leaf, × 35; **22.** sporophyte, × 5; **23.** part of capsule wall showing cells and stoma, × 350; **24.** part of capsule mouth showing cells and peristome, × 175; **25.** spore, × 700. (1 & 4–9, *Rehmann* 214; 2, 3, 10 & 11, *Cholnoky* 442; 12, 15, 17 & 21–24, *Esterhuysen* 34594; 13, 16 & 18–20, *Smook* 1095; 14, *Van Rooy* 21).



MAP 135.— ● **Anomobryum filiforme**

along the Drakensberg of Natal, Lesotho and Transvaal and also in the eastern Cape, Natal Midlands, Zululand, eastern Orange Free State, southern, central, eastern and northern Transvaal. Map 135.

Vouchers: *Cholnoky* 127, 461; *Hardy* 3942; *Magill* 4328; *Oliver* 6752; *Van Rooy* 44, 341, 1493, 1632.

This species can be recognized by the julaceous, yellowish green, glossy plants and the evenly spaced leaves with costae ending below the apex, the denticulate upper margins and linear-vermicular, incrassate upper laminal cells.

2. **Anomobryum drakensbergense** *Van Rooy* in Bothalia 16: 42 (1986). Type: Natal, Organ Pipes Pass, *Esterhuysen* 34594 (PRE, holo.!; MO; BOL).

Plants small to medium-sized, caespitose, yellowish green to brownish above, yellow-brown to brown below; saxicolous or terricolous. *Stems* to 20 mm tall, branching by forks or subperichaetial innovations, frequently tomentose below, yellowish green or reddish brown to brown; in section round, central strand of thin-walled cells present, inner cortical cells in 2–4 rows, thin-walled, outer cortical cells 1–2 rows, thin-walled to incrassate. *Leaves* ± equidistant, about equal in size or subperichaetial leaves larger, imbricate, frequently concave, erect when dry, erect-spreading when wet; shortly oblong-acute or ovate to ovate-lanceolate, (0,5–)0,6–1,5 mm long; apex acute; margins plane or rarely recurved, entire; border absent. *Costa* percurrent or occasionally mucronate, generally yellow, frequently reddish below; in section subround to round, laminal insertion ventral, ventral surface cells present, guide cells incrassate, dorsal stereid band strong, dorsal surface cells incrassate. *Upper laminal cells* short-rhomboidal to linear-rhomboidal, occasionally vermicular, frequently incrassate, (25–)35–63(–85) μm long, 7–19 μm wide; basal laminal cells frequently reddish, quadrate.

Dioicous. Perichaetia terminal but quickly overgrown by innovations; leaves ovate-lanceolate to lanceolate, upper laminal cells vermicular. *Seta* 10–16 mm long, yellowish red or reddish brown; capsule pyriform, inclined to horizontal, yellowish to reddish or brown, frequently contracted below mouth when dry, urn 1,0–1,8 mm long, neck 0,5–1,5 mm long, wrinkled when dry; exothecial cells irregularly rectangular to quadrate, incrassate, smaller at mouth; stomata present on neck, phaneropore; annulus differentiated; *peristome* teeth narrowly oblong-acuminate, frequently blunt and irregular in outline, 190–300 μm long, bordered, trabeculate, yellowish to reddish, frequently hyaline above, minutely papillose, endostome segments broad below, tapering above, keeled, broadly perforated, yellowish to hyaline, cilia rudimentary, basal membrane high, yellow, minutely papillose; operculum conic, blunt to mucronate; calyptra cucullate; spores 12–18 μm, granulose. Fig. 102: 12–25.

The species is known from the Drakensberg of Natal and mountains of Lesotho where it grows on soil in rock crevices, from 2 100–3 050 m. Map 136.

Vouchers: *Esterhuysen* 21623, 35941; *Magill* 4142a, 4604, 4705; *Smook* 1089, 1095, 1096a; *Van Rooy* 21, 1087, 1090.

The species will be recognized by its habit, branching patterns of the stem, leaf shape and areolation. *A. drakensbergense* can be distinguished from *A. filiforme* by the percurrent costa, entire leaf margins, shorter and wider upper laminal cells and reduced peristome.

MAP 136.— ● **Anomobryum drakensbergense**

8. BRYUM

Bryum *Hedw.*, Sp. Musc. 178 (1801); Broth. in Natürl. PflFam. 10: 374 (1924); Sim, Bryo. S. Afr. 326 (1926); Andrews in Grout, Moss Fl. N. Amer. 2: 211 (1935); Sainsb., N. Zeal. Mosses 265 (1955); Gangulee, Moss. E. India 4: 961 (1974); Smith, Moss Fl. Brit. Irel. 383 (1978); Catcheside, Moss. South Austr. 250 (1980); Crum & Anderson, Moss. E. N. Amer. 1: 538 (1981). Lectotype species: *B.argenteum* Hedw.; fide Britton, Fl. Bermuda 442 (1916).

Plants small to robust, gregarious or caespitose, whitish to silvery green or yellowish green to green or reddish green to red, occasionally glossy; terricolous to saxicolous, corticolous or humicolous. *Stems* erect, frequently branching by subperichaetial innovations, frequently tomentose below; tubers occasionally produced, on long or short rhizoids, subterranean or axillary; in section round, central strand present, inner cortical cells in 2−5 rows, thin-walled, outer cortical cells in 1−2 rows, smaller, frequently incrassate or stereids. *Leaves* orbicular, ovate to lanceolate, elliptical, oblong to obovate or spathulate, equidistant to crowded above, about equal in size or larger above; margins plane to recurved, entire to denticulate or dentate above, border present or absent. *Costa* ending below apex or percurrent to excurrent as short or long awn; in section bulging dorsally, dorsal stereid band weak to strong. *Upper laminal cells* hexagonal, rhomboidal or linear-rhomboidal, occasionally vermicular; basal cells quadrate to rectangular. Propagulae infrequent, bud-like, axillary; filamentous gemmae rare, axillary or on leaf lamina.

Dioicous, synoicous or autoicous. Perichaetia terminal but frequently overgrown by subperichaetial innovations. *Seta* elongate, erect; capsules inclined to pendulous, ovoid or oblong-cylindrical to pyriform or clavate, straight or curved, neck differentiated; stomata on neck, phaneropore; annulus differentiated; peristome double, exostome teeth 16, narrowly oblong-acuminate, frequently bordered, trabeculate at back, papillose or rarely striolate below, endostome segments perforated, cilia absent or 2−4, nodose to appendiculate, basal membrane low or high; operculum conic, blunt to apiculate or mammillate; calyptra cucullate; spores round.

Bryum is found throughout the world and is one of the largest moss genera with c. 800 species. South America is the major centre of described species, followed by tropical Africa and Europe. Sterile plants can usually be recognized by the subperichaetial branching, the relatively broad leaves crowded towards the stem apex with the lower leaves smaller, the strong costae and the typical smooth, broad, hexagonal to rhomboidal laminal cells. Fertile plants are recognized by their inclined to pendulous, narrowly pyriform capsules with double, generally well developed peristomes. Some species of *Bryum* may be mistaken for *Brachymenium*, *Plagiobryum* or *Rhodobryum*; see notes under those genera.

The genus is difficult to treat taxonomically and the positive results obtained by regional studies and studies on critical groups (Crundwell & Nyholm, 1964; Ochi, 1970, 1972; Syed, 1973; Smith & Whitehouse, 1978; Mohamed, 1979) underline the need for more research and a monographic study of *Bryum*. Many species have recently been reduced to synonymy while other species with broad morphological variation have been shown to consist of aggregates or complexes of several species or infraspecific taxa.

The presence or absence, position, size, colour and shape of propagulae, gemmae and rhizoidal gemmae (tubers) have proved to be important taxonomic characters. Because of their size and colour, subterranean tubers are difficult to locate and can easily be overlooked. Care should be taken when studying mixed collections of *Bryum* since it is often difficult to prove to which plant the tubers belong. The costal anatomy is also a useful taxonomic character in some instances. Cross-sections should be taken from the lower third of the leaf as the costa is occasionally weak above.

In addition to the key, species descriptions and illustrations, familiarity with the species is often required to identify plants. The variability expressed by most of the species makes identification of some specimens, especially sterile ones, very difficult.

1 Leaf border absent or laminal cells gradually narrowed towards margin:
  2 Plants whitish or silvery green; upper laminal cells hyaline ..... 2. *B. argenteum*
  2 Plants variously green, not whitish; laminal cells chlorophyllose:
    3 Axillary tubers present, cells protuberant ..... 6. *B. nitens*
    3 Axillary tubers absent:
      4 Leaf margins recurved to revolute above:
        5 Costa long excurrent ..... 11. *B. caespiticium*
        5 Costa percurrent to short excurrent ..... 7. *B. alpinum*

4 Leaf margins plane above:
6 Leaves generally equidistant and about equal in size, occasionally larger above; plants frequently shiny:
7 Plants small; leaves <1 mm long, cells lax.....1. *B. cellulare*
7 Plants medium-sized to large; leaves >1 mm long, cells firm-walled to incrassate .....7. *B. alpinum*
6 Leaves more crowded towards stem apex or comose, larger above; plants not distinctly shiny:
8 Costa ending below apex to percurrent.....7. *B. alpinum*
8 Costa excurrent:
9 Plants small to medium-sized; leaves erect-spreading when wet, not in rosettes, generally <2 mm long, apex acute to acuminate:
10 Comal leaves appressed dry, broadly ovate or subtriangular ..... .4. *B. radiculosum*
10 Comal leaves erect and occasionally twisted dry, ovate-lanceolate, lanceolate, oblong-lanceolate or elliptical:
11 Tubers brownish; leaves ovate to ovate-lanceolate, costa generally long excurrent.....3. *B. bicolor*
11 Tubers reddish; leaves lanceolate, oblong-lanceolate or elliptical, costa mucronate to short excurrent ..... .5. *B. microerythrocarpum*
9 Plants medium-sized to large; leaves frequently in rosettes, generally >2 mm long, apex acute to obtuse:
12 Upper laminal cells 25–36 μm long; leaf apex generally obtuse ..... .14. *B. viridescens*
12 Upper laminal cells 40–100 μm long; leaf apex generally acute .....15. *B. canariense*
1 Leaf border 1–12 cells wide, occasionally weak:
13 Leaf margins recurved to revolute above, apex acuminate .....11. *B. caespiticium*
13 Leaf margins plane above, apex generally acute:
14 Leaf border bi- to multistratose:
15 Leaves ovate, ovate-lanceolate or lanceolate, 1,2–2,5 mm long; border indistinct, unistratose to bistratose; margins generally plane .....10. *B. turbinatum*
15 Leaves elliptical to obovate, 2,4–3,7 mm long; border distinct, generally multistratose; margins recurved below .....13. *B. donianum*
14 Leaf border unistratose:
16 Leaves frequently decurrent.....12. *B. pseudotriquetrum*
16 Leaves not or rarely decurrent:
17 Plants small to medium-sized; leaves spirally twisted around stem; tubers frequently present:
18 Tubers brown; leaves 1,0–1,8 mm long, border inconspicuous, 1–2(–3) cells wide; mostly sterile.....8. *B. capillare*
18 Tubers red; leaves 2–4 mm long, border conspicuous, 2–3 cells wide; frequently fruiting ..... .9. *B. torquescens*
17 Plants medium-sized to robust; leaves not spirally twisted around stem, variously twisted; tubers occasionally persent:
19 Costa in section subround to round, dorsal stereid band well defined:
20 Leaves ovate, ovate-lanceolate or lanceolate; margins generally plane; border indistinct .....10. *B. turbinatum*
20 Leaves elliptical, oblong, oblong-spathulate or spathulate; margins recurved to revolute below; border distinct:
21 Upper laminal cells long-rhomboidal, generally 50–80 μm long:
22 Laminal cells gradually narrowed towards border, border 4–8 cells wide; tubers large, mostly 350–550 μm .....16. *B. erythrocaulon*
22 Laminal cells abruptly narrowed at border, border 2–3 cells wide; tubers smaller, mostly 170–280 μm ..... .9. *B. torquescens*
21 Upper laminal cells short-rhomboidal, generally 30–55 μm long:
23 Axillary filamentous gemmae frequently present; leaves generally flat, border 2–6 cells wide ..... .18. *B. andicola*
23 Filamentous gemmae absent; leaves frequently concave, border 4–12 cells wide .....17. *B. perlimbatum*
19 Costa in section subrectangular, dorsal stereid band not well defined or absent, substereids frequently present:

24 Leaf margin denticulate to dentate, border conspicuous, 2–5 cells wide; filamentous gemmae absent ..... 19. *B. pycnophyllum*

24 Leaf margin strongly dentate to spinose, border inconspicuous, 1–3 cells wide; filamentous gemmae frequently present on leaf lamina; ..... 20. *B. aubertii*

1. **Bryum cellulare** *Hook.* in Schwaegr., Sp. Musc. Suppl. 3(1): 214a (1827); Broth. in Natürl. PflFam. 10: 384 (1824); Bartram, Mosses of the Phillipines 138 (1939); Ochi in J. Fac. Educ. Tottori Univ. 24: 42 (1973); Gangulee, Moss. E. India 4: 969 (1974). Type: Asia.

Bryum argenteum var. *rotundifolium* Sim, Bryo. S. Afr. 328 (1926). Type: Natal, Giants Castle, *Symons* sub *Sim* 10210 (PRE, lecto.!, selected here).

Plants small, caespitose, pale green or reddish green above, reddish, yellowish or red-brown to brown below, slightly glossy; saxicolous and terricolous. *Stems* 3–20 mm tall, simple or branching by subperichaetial innovations, red to brown, tomentose below; rhizoids reddish brown, papillose, tubers 80–220 μm, reddish brown. *Leaves* equidistant, about equal in size, erect when dry, erect to erect-spreading when wet, concave; orbicular or ovate to oblong, (0,2–)0,4–0,8(–1,0) mm long; apex acute to rounded; margins plane, entire; border absent or rarely 1 cell wide. *Costa* weak, ending well below apex to percurrent or rarely mucronate, red or reddish brown; in section round, ventral surface cells generally present, dorsal cells incrassate to stereids, hydroids absent. *Upper laminal cells* lax, hexagonal or rhomboidal to subrectangular, (25–)32–100(–138) μm long, (10–)12–28(–35) μm wide; basal cells lax, subrectangular to rectangular or quadrate.

Dioicous. Perichaetia terminal; leaves oblong to oblong-lanceolate, 1,0–1,8 mm long, inner leaves smaller, triangular. *Seta* 7–12 mm long, yellowish to reddish brown; capsule inclined to horizontal, clavate-cylindrical, urn 1,3 mm long, neck 0,6 mm long; exothecial cells thin-walled, irregular in shape, smaller towards mouth, incrassate at mouth; stomata phaneropore; annulus present; *peristome* double, exostome teeth yellow to orange, hyaline above, narrowly oblong-acuminate, 0,3 mm long, striolate below, minutely papillose above, endostome segments linear, narrowly perforated, yellowish to orange, cilia absent, basal membrane low; operculum conic, rostellate; calyptra not seen; spores 20–28 μm, finely papillose. Fig. 103: 1–13.

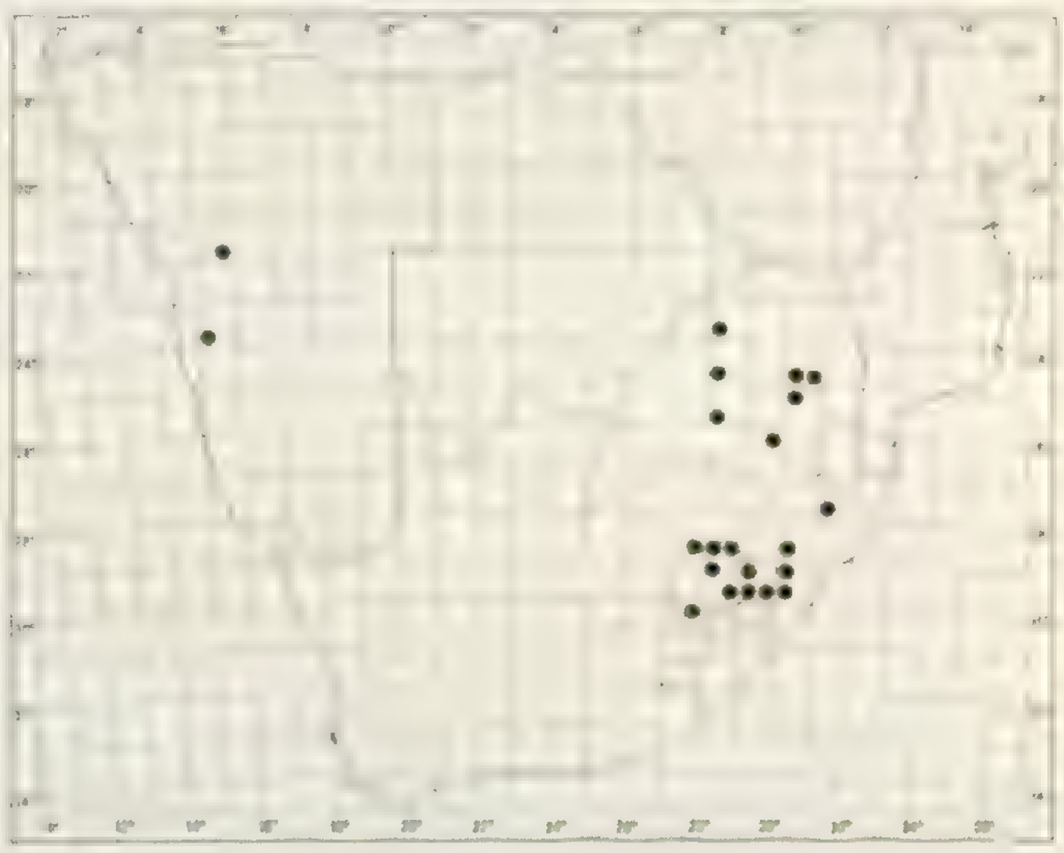
Bryum cellulare is known from Australia, Oceania, Japan, southern Asia, India, southern Europe and northern, central and southern Africa. In the Flora area the species is infrequently collected in Lesotho, eastern Orange Free State, Natal, Zululand, southern, central and eastern Transvaal and South West Africa/Namibia. Map 137.

Vouchers: *Cholnoky* 163a, 169; *Farkas* 14b; *Oliver* 7070; *Perold* 39, 367; *Phelan, Smook & Taylor* 57; *Van Rooy* 442.

A group of specimens from Transvaal and Zululand (*Cholnoky* 163a; *Perold* 39; *Retief et al.* 1138; *Wager* 243, 1426) including the only fruiting specimen (*Farkas* 14b), have costae ending well below the leaf apices and resemble *B. pocsii* Bizot. In the original description of *B. pocsii*, it is distinguished from *B. cellulare* on the basis of the shorter costa. Variation in the length of the costa, from ending well below the apex to percurrent, was observed in some specimens (*Cholnoky* 169). A narrow, indistinct leaf border is occasionally produced by southern African plants in this group. *B. pocsii* probably represents an undescribed variety of *B. cellulare*.

The majority of southern African specimens belong to a second group with smaller, rounder leaves, smaller laminal cells and percurrent costae. Plants in this group generally lack leaf borders. Some specimens collected in Lesotho (*Magill* 4157, 4218, 4649) have short, round leaves but agree in other characters with plants in this second group. The type of *B. argenteum* var. *rotundifolium* also belongs to this group. The specimen, *Symons* sub *Sim* 10210 is selected as lectotype because it closely matches the protologue and the word 'type' appears on the original label in Sim's handwriting. No fruiting material has been seen but tubers are occasionally found in specimens belonging to this group.

Sterile plants of *B. cellulare* can be recognized by the evenly spaced, reddish green, glossy, concave leaves with lax laminal cells, entire and plane margins without a distinct



MAP 137.— ● **Bryum cellulare**

leaf border and distinctly larger perichaetial leaves. Fruiting specimens of *B. cellulare* are easily separated from other taxa in Bryaceae. Gametophytically the species resembles *B. nitens* but the shorter leaves and laminal cells, glossy plants and the absence of axillary tubers with protuberant cells will distinguish it from that species. *B. cellulare* may also be confused with *Plagiobryum zierii*, but that species has hyaline leaf apices.

2. **Bryum argenteum** *Hedw.*, Sp. Musc. 181 (1801); Lawton, Moss Fl. Pacific Northwest 165 (1971); Ochi in J. Fac. Educ. Tottori Univ. 23: 45 (1972); Scott & Stone, Moss. S. Austr. 273 (1976); Crum & Anderson, Moss. E. N. Amer. 1: 570 (1981). Type: Europe.

Bryum stellipilum C. Müll. in Hedwigia 38: 66 (1899). Type: Transvaal, Spitzkop prope Lydenburg, *Wilms* s.n., Feb. & Apr. 1887 (G!).

Bryum capensiargenteum C. Müll. in Hedwigia 38: 67 (1899), fide Ochi in J. Fac. Educ. Tottori Univ. 23: 46 (1972). Type: Cape, Boschberg prope Somerset East, *MacOwan* s.n. (L, iso.).

Bryum oranicum C. Müll. in Hedwigia 38: 68 (1899). *B. argenteum* var. *australe* Sim, Bryo. S. Afr. 328 (1926). Type: Orange Free State, *Rehmann* 260 (PRE, iso.!).

Bryum argenteum var. *proliferum* Sim, Bryo. S. Afr. 328 (1926). Type: *Sim* s.n.

Bryum argenteum var. *viride* Sim, Bryo. S. Afr. 328 (1926). Type: none cited.

Plants small to medium-sized, forming turfs or cushions, whitish or silvery green to green above, green below; terricolous or saxicolous. *Stems* julaceous, (1,0−)5,0−25,0 mm tall, branching below, yellowish green or red to red-brown, frequently radiculose below; rhizoids red-brown, coarsely papillose, tubers absent. *Leaves* crowded, occasionally distant below, imbricate wet or dry, concave; broadly ovate to oval or broadly oblong to obovate, 0,5−1,5 mm long; apex hyaline, apiculate to acuminate; margins plane, entire; border absent. *Costa* ending below apex to aristate, weak, frequently reddish below, awn to 0,8 mm long, hyaline, frequently denticulate; in section subround, ventral surface cells 2−3, dorsal stereid band present, stereids in 1−2 rows, dorsal surface cells incrassate, guide cells absent, hydroids few. *Upper laminal cells* hyaline, rhomboidal, occasionally flexuose, frequently thickened at the corners, (25−)37−75(−100) μm long, 10−17 μm wide, narrowly rectangular at margin; basal cells frequently reddish, quadrate to rectangular, extending up margin in 2−4 rows. Propagulae occasionally present in leaf axils.

Dioicous. Perichaetia terminal; leaves oblong-acuminate to triangular, 1,0−1,5 mm long. *Seta* 7−12(−20) mm long, yellowish or red to reddish brown; capsule pendulous, ovoid or pyriform, 1−2 mm long, yellowish to reddish yellow or dark red to reddish brown, contracted below mouth when dry, neck short, occasionally larger than urn, frequently abruptly narrowed towards seta, wrinkled when dry; exothecial cells irregularly rectangular, incrassate, shorter towards mouth, 2−4 rows at mouth transversely elongated; *peristome* double, exostome teeth yellowish to dark red or reddish brown, apex hyaline, narrowly oblong-acuminate, 0,2−0,4 mm long, finely papillose, endostome segments keeled, perforated, cilia 2−3, basal membrane high, minutely papillose, yellowish; operculum low-conic, blunt to apiculate; spores 10−15 μm, finely papillose. Fig. 103: 14−20.

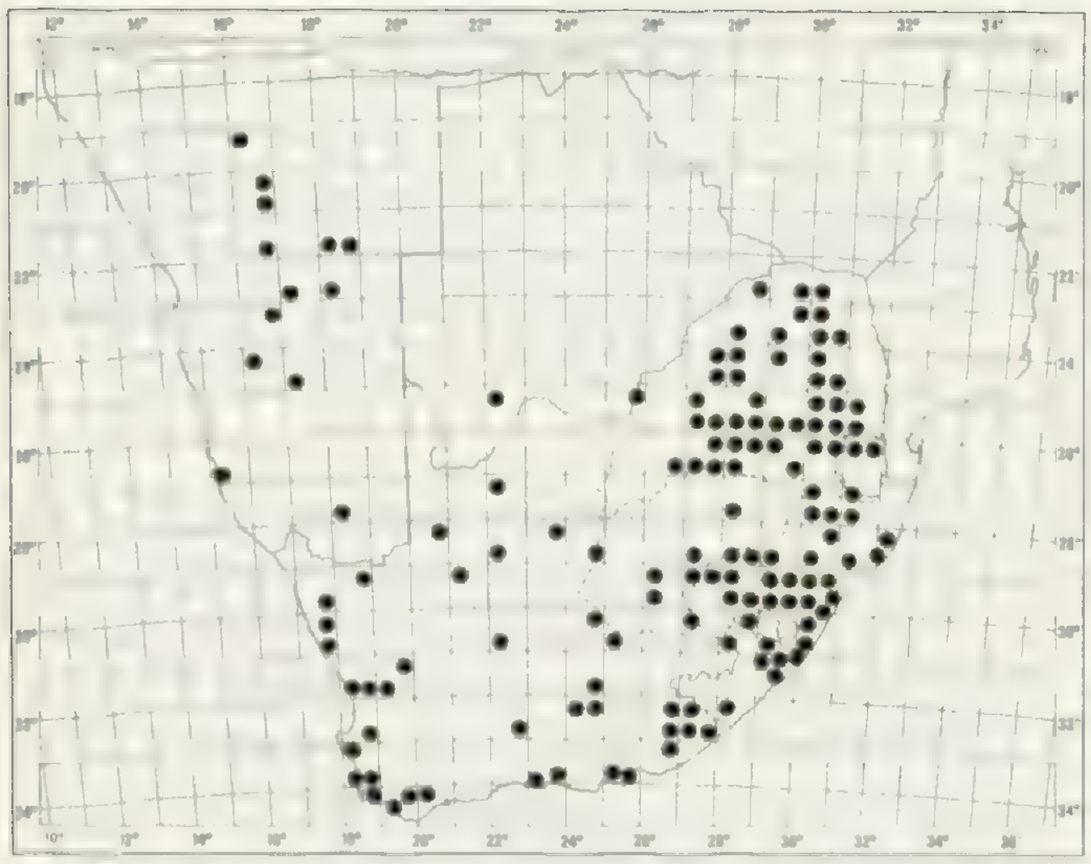
Bryum argenteum is cosmopolitan in distribution and common throughout the Flora area. It is frequently found in disturbed places and even cities where it grows along paths, tarred roads, on walls, roofs and other concrete structures. Map 138.

Vouchers: *Kemp* 1449; *Killick* 4215; *Kluge* 1039; *Magill* 3147, 4315, 4920; *Smook* 1086; *Smook & Phelan* 671; *Van Rooy* 2, 487, 703, 1375; *Volk* 01162.

Bryum argenteum is most easily identified by the whitish or silvery green appearance of the julaceous stems and the broadly ovate, concave leaves with hyaline upper laminal cells.

Considerable variation in plant and leaf size, leaf shape, acumen length and nerve length is present in southern African plants. For example, the nerve may end below the apex, extend into the acumen or become long-excurrent as a toothed awn. A continual gradation in nerve length was

FIG. 103.—**Bryum cellulare** (1–13): **1.** habit, × 1; **2.** habit, × 2,5; **3.** stem in cross section, × 70; **4.** leaves, × 35; **5.** leaf in proximal cross section, × 175; **6.** basal leaf cells, × 175; **7.** leaf apex, × 175; **8.** rhizoid with tuber, × 70; **9.** perichaetial leaf, × 35; **10.** sporophyte, × 2,5; **11.** part of capsule wall showing cells and stoma, × 175; **12.** part of capsule mouth showing cells and peristome, × 175; **13.** spore, × 700. **B. argenteum** (14–20): **14.** habit, × 1; **15.** habit, × 2,5; **16.** leaves, × 35; **17.** leaf in proximal cross section, × 175; **18.** basal leaf cells, × 70; **19.** leaf apex, × 175; **20.** propagula, × 70. **B. bicolor** (21–28): **21.** habit, × 1, **22.** habit, × 2,5, **23.** leaf, × 35, **24.** leaf in proximal cross section, × 175, **25.** basal leaf cells (left side), × 175; **26.** leaf apex, × 175; **27.** propagula, ×70; **28.** rhizoid with tuber, × 70. (1 & 2 *Oliver* 7070; 3, 4 & 9, *Cholnoky* 169; 4, 6 & 8, *Anderson* 15; 5, *Perold* 367; 7, *Schelpe* 2088a; 10–13 *Farkas* 14b, 14, *Van Rooy* 487; 15, *Anderson* PRE-CH13277; 16, *Hardy* 5340 & *Tölken* 5587; 17, *Oliver* 7351; 18, *Perold* 58, 19, *Magill* 4315; 20, *Filter* PRE-CH12602; 21 & 22, *De Winter* 9300; 23–26, *Van Rooy* 304; 27, *Magill* 6325; 28, *Van Rooy* 775.)



MAP 138.— ● **Bryum argenteum**

observed in southern African plants and the length of the nerve frequently varies among plants in a population or even leaves on the same plant.

Plants of *B. argenteum* with excurrent costae are often treated as the var. *lanatum* (P. Beauv.) Hampe and many southern African specimens were also referred to *B. arachnoideum* C. Müll. The varieties described by Sim (1926) and treated here as synonyms represent different races of *B. argenteum* in southern Africa.

Plants with a rounded leaf apex, costa ending well below the apex and the apiculus short or absent (*Van Zinderen Bakker* 453; *Magill* 7065, 7145; *Perold* 1; *Van Rooy* 5) resemble the Angolan *B. albopulvinatum* C. Müll. These plants conform well in other characters to *B. argenteum* and as the leaf shape and development of the apiculus are variable among southern African plants, they are treated here provisionally. More specimens from the rest of Africa should be studied to properly assess the relationship between *B. albopulvinatum* and *B. argenteum*.

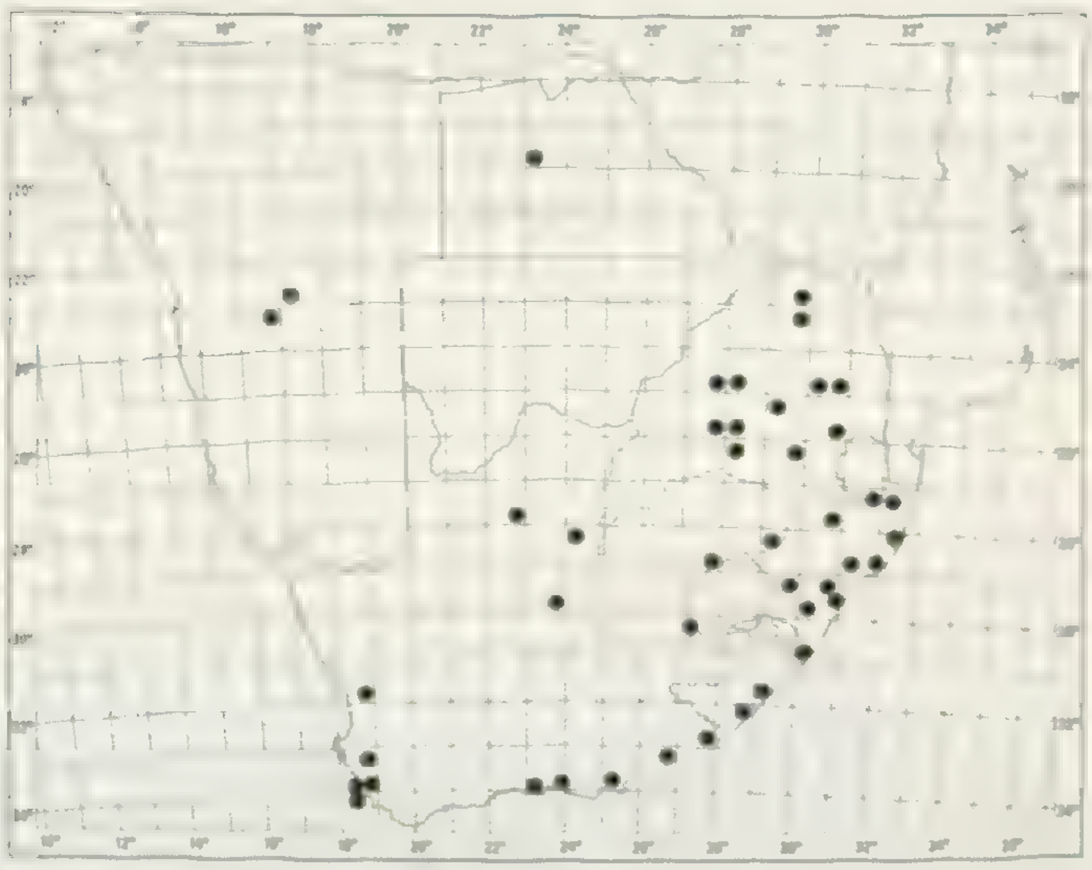
3. **Bryum bicolor** *Dicks.*, Pl. Crypt. Brit. 4: 16 (1801); Broth. in Natürl. PflFam. 10: 393 (1924); Ochi in J. Fac. Educ. Tottori Univ. 23: 51 (1972); Flowers, Mosses: Utah and the West 378 (1973); Crum & Anderson, Moss. E. N. Amer. 1: 564 (1981). Type: Europe.

Bryum rigidicuspis Dix. in S. Afr. J. Sci. 18: 320 (1922); Broth. in Natürl. PflFam. 11: 530 (1925); Sim, Bryo. S. Afr. 330 (1926). Syntypes: Natal, Van Reenen Pass, *Wager* 74; Zimbabwe, Zimbabwe, *Sim* 8790; Khami Ruins, *Sim* 8839, 8867 (all PRE!).

Plants small, loosely caespitose to caespitose, yellowish green to green above, brownish below; terricolous. *Stems* 3−15 mm tall, simple or branching by subperichaetial innovations, occasionally tomentose below; rhizoids reddish to reddish brown, papillose, tubers 100−360 μm, brown. *Leaves* comose, erect to erect-spreading when dry, erect-spreading when wet, slightly concave; ovate to ovate-lanceolate or lanceolate, (0,3−)0,5−1,0(−1,2) mm long; apex acuminate; margins plane to recurved below, entire to denticulate above; border absent. *Costa* strongly aristate, awn 80−340(−480) μm long, smooth to denticulate above, yellowish green or reddish; in section round, laminal insertion ventral, ventral surface cells present, dorsal stereid band strong, dorsal surface cells incrassate, hydroids present between guide cells and stereid band. *Upper laminal cells* rhomboidal, thin-walled to incrassate, 22−68 μm long, 7−15 μm wide; basal cells rectangular to quadrate, occasionally reddish below. Propagulae bud-like, axillary, 180−600 μm long.

Dioicous. Perichaetia terminal, leaves lanceolate to triangular. *Seta* 6−15(−22) mm long, yellowish or red to reddish brown; capsule horizontal to pendulous, ovoid or shortly oblong-cylindrical, 0,8−1,8 mm long, dark red or reddish brown when mature, slightly contracted below mouth when dry, neck short, frequently broadly rounded to seta, wrinkled when dry; exothecial cells irregular in shape, incrassate, smaller towards mouth; *peristome* double, exostome teeth yellow to orange, endostome segments tapering above, widely perforated, cilia 2−3, appendiculate, basal membrane high, finely papillose, yellowish; operculum mammillate; spores 8−10 μm, minutely papillose. Fig. 103: 21−28.

The species is almost cosmopolitan in distribution. In southern Africa *B. bicolor* is collected on soil in the northwestern, southwestern, southern, eastern, central and northern Cape, Transkei, eastern Orange Free State, Natal, Zululand, southern, central, eastern and northern Transvaal, South West Africa/Namibia and Botswana. The species is frequently collected in disturbed places. Map 139.



MAP 139.— ● **Bryum bicolor**

Vouchers: *Anderson* PRE-CH12832; *De Winter* 9300; *Garside* 6230; *Hoffman* 44; *Smook* 895, 2271; *Taylor* 475; *Van Rooy* 304, 398, 614, 1985, 2189.

Bryum bicolor is recognized by the ovate to ovate-lanceolate leaves with yellowish, strongly aristate costae, absence of a leaf border, axillary propagulae and short, thick capsules with short, rounded necks. Brownish tubers are frequently produced although specimens with reddish (*Retief* 1239a) and yellowish tubers with larger cells (*Cholnoky* 706, 708) were also found.

Wilczek & Demaret (1976) and Smith & Whitehouse (1978) described several species from the *B. bicolor* complex in Europe. Southern African plants are treated as *B. bicolor* until a world-wide study can properly assess the relationships within this complex.

Bryum rigidicuspis has rounded leaf apices and longer setae but agrees in other characters with *B. bicolor*. Sterile plants of *B. rigidicuspis* may be confused with *B. capillare* but the spirally twisted leaves, rounded leaf apices and leaf areolation will identify *B. capillare*.

In the absence of tubers or propagulae, immature specimens of *B. bicolor* may be mistaken for sterile *Archidium* Brid. plants, especially *A. acanthophyllum* Snider. *B. bicolor* can also be confused with sterile plants of small *Brachymenium* species, e.g. *B. dicranoides* which is a smaller plant with smaller leaves (see note under that species). Specimens with broadly ovate leaves and shorter costae (*Garside* 6230, 6277) resemble *Bryum radiculosum* but are treated here provisionally. For differences between *B. bicolor* and *B. radiculosum* see note under that species.

4. **Bryum radiculosum** *Brid.*, Sp. Musc. 3: 18 (1817); Crundwell & Nyholm in Trans. Brit. bryol. Soc. 4 (4): 603 (1964); Ochi in J. Fac. Educ. Tottori Univ. 23: 54 (1972). Type: Italy, Rome, 1806, Herb. Brid. (B, holo.!).

?Bryum subdecursivum C. Müll. in Hedwigia 38: 74 (1899); Broth. in Natürl. PflFam. 10: 394 (1924). Type: Cape, Cape Town, *Rehmann* 254 (BM, iso.!).

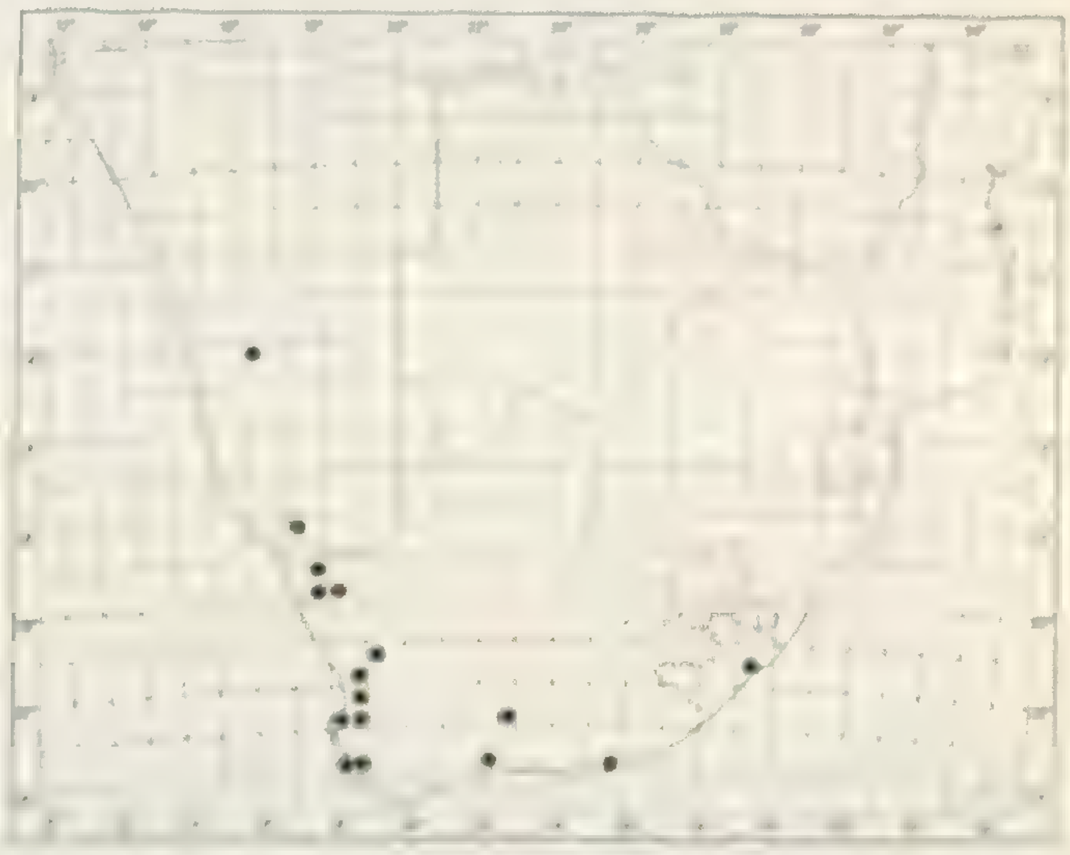
Bryum subcavifolium Dix. in Sim, Bryo. S. Afr. 332 (1926), fide Ochi in J. Fac. Educ. Tottori Univ. 23: 54 (1972). Type: Cape, Camps Bay, *Rehmann* 255 (BM, holo.).

Plants small, loosely caespitose to caespitose, yellowish green or reddish green above, reddish brown to brown below; terricolous. *Stems* 2–10 mm tall, simple or branching by subperichaetial innovations, occasionally tomentose below; rhizoids red-brown or brownish, papillose, tubers 120–240 μm, pale brown to reddish brown. *Leaves* comose, smaller below, imbricate above when dry, erect to erect-spreading wet, concave; broadly ovate to triangular, 0,5–1,1 mm long; apex acute to acuminate; margins plane to frequently recurved, entire to denticulate above; border absent. *Costa* strong, mucronate to shortly aristate, yellowish to red, occasionally hyaline above, awn 0,1–0,3 mm long; in section subround to round, laminal insertion ventral, ventral surface cells present, dorsal stereid band strong, stereids in 2–4 rows, dorsal surface cells incrassate, hydroids present between guide cells and stereid band. *Upper laminal cells* rhomboidal, thin-walled to incrassate, (25–) 35–63 μm long, 10–23 μm wide; basal cells quadrate to short-rectangular, frequently thickened at the corners, generally pitted. Gemmae occasionally present, ovoid, stalked, axillary, green to yellowish green or reddish brown to brown, 80–200 μm long.

Dioicous. Perichaetia terminal, leaves oblong-lanceolate to triangular. *Seta* 15–18 mm long, red to reddish brown; capsule pendulous, ovoid, 1,0–1,8 mm long, red, neck short, broadly rounded to seta, wrinkled when dry; exothecial cells irregular in shape, incrassate, shorter towards mouth; 2–3 rows at mouth transversely elongated; *peristome* double, exostome teeth oblong-acuminate, reddish or orange, hyaline above, finely papillose, endostome segments tapering above, widely perforated, cilia 2–3, appendiculate, basal membrane high, yellowish, finely papillose; operculum convex, mammillate; spores 12–15 μm, smooth to weakly papillose. Fig. 104: 1–9.

This species is known from Europe, southeast Asia, Japan, Oceania, Australia, North America and northern and southern Africa. In southern Africa *B. radiculosum* is occasionally collected in the central, southern, southwestern and northwestern Cape, Transkei and South West Africa/Namibia. Map 140.

Vouchers: *Magill* 3964, 4023a; *Magill & Schelpe* 3922; *Oliver* 345; *Perold* 462, *Schelpe* 7739, 7774; *Surton* 9097; *Van Rooy* 717.



MAP 140. — ● **Bryum radiculosum**

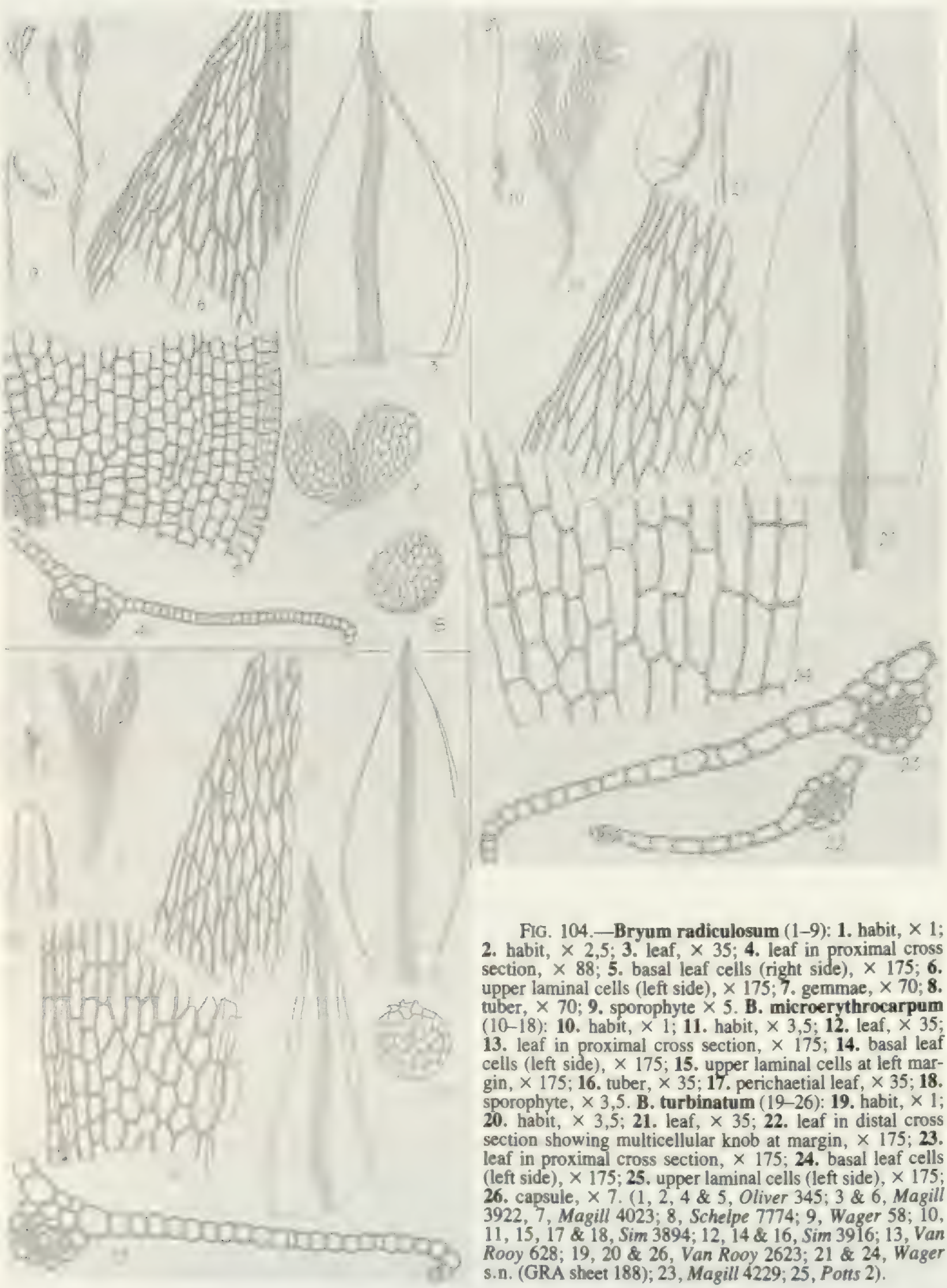


FIG. 104.—**Bryum radiculosum** (1–9): **1.** habit, × 1; **2.** habit, × 2,5; **3.** leaf, × 35; **4.** leaf in proximal cross section, × 88; **5.** basal leaf cells (right side), × 175; **6.** upper laminal cells (left side), × 175; **7.** gemmae, × 70; **8.** tuber, × 70; **9.** sporophyte × 5. **B. microerythrocarpum** (10–18): **10.** habit, × 1; **11.** habit, × 3,5; **12.** leaf, × 35; **13.** leaf in proximal cross section, × 175; **14.** basal leaf cells (left side), × 175; **15.** upper laminal cells at left margin, × 175; **16.** tuber, × 35; **17.** perichaetial leaf, × 35; **18.** sporophyte, × 3,5. **B. turbinatum** (19–26): **19.** habit, × 1; **20.** habit, × 3,5; **21.** leaf, × 35; **22.** leaf in distal cross section showing multicellular knob at margin, × 175; **23.** leaf in proximal cross section, × 175; **24.** basal leaf cells (left side), × 175; **25.** upper laminal cells (left side), × 175; **26.** capsule, × 7. (1, 2, 4 & 5, *Oliver* 345; 3 & 6, *Magill* 3922, 7, *Magill* 4023; 8, *Schelpe* 7774; 9, *Wager* 58; 10, 11, 15, 17 & 18, *Sim* 3894; 12, 14 & 16, *Sim* 3916; 13, *Van Rooy* 628; 19, 20 & 26, *Van Rooy* 2623; 21 & 24, *Wager* s.n. (GRA sheet 188); 23, *Magill* 4229; 25, *Potts* 2).

Bryum radiculosum can be mistaken for *B. bicolor* but the broader leaves, appressed towards the stem apex when dry, with stronger recurved margins and shorter excurrent costae and the axillary gemmae will usually separate *B. radiculosum*. This species is generally found in the southern and western Cape while *B. bicolor* ranges northward into the Transvaal. Propagulae similar to those of *B. bicolor* were found in some specimens (*Magill* 3953, 3962) but the plants conform well in other characters to *B. radiculosum*. A few specimens resembling *B. bicolor* (*Schelpe* 7799, 7819; *Oliver* 364b; *Anderson* 21) were difficult to place but are treated here provisionally. The specimen *Rehmann* 252 with lanceolate leaves and longer excurrent costae is treated here because of the axillary gemmae.

The type specimen of *B. subcavifolium* was not available to Sim (1926) and has not been located for this study. The original description by Dixon in Sim (1926) agrees well with *B. radiculosum* and we therefore follow Ochi (1972) in reducing it to synonymy. Ochi (1972) referred *B. subdecursivum* to *Brachymenium exile* (Doz. & Molk.) Bosch. & Lac. The type specimen in BM is sterile and is treated here on vegetative characters alone. *Bryum subdecursivum* is not synonymous with *B. argenteum* as suggested by Sim (1926).

In their treatment of the European species of *B. erythrocarpum* complex Crundwell & Nyholm (1964) did not report stalked, axillary gemmae for this species and no gemmae could be found in the type specimen. Additional separating characters were not found in southern African plants bearing gemmae.

5. **Bryum microerythrocarpum** *C. Müll. & Kindb.* in Macoun, Cat. Can. Pl. 6: 124 (1892); Broth. in Natürl. PflFam. 10: 394 (1924); Crundwell & Nyholm in Trans. Br. bryol. Soc. 4: 622 (1964); Lawton, Moss Fl. Pacific Northwest 170 (1971); Ochi in J. Fac. Educ. Tottori Univ. 23: 54 (1972); Smith, Moss Fl. Brit. Irel. 425 (1978). Type: Canada.

Bryum zuluense Broth. & Bryhn, Forh. Vid. Selsk. Christiania 1911: 14 (1911); Broth. in Natürl. PflFam. 10: 394 (1924). Type: Zululand, Eshowe, Jan. 1909, *Bryhn* s.n. (H!).

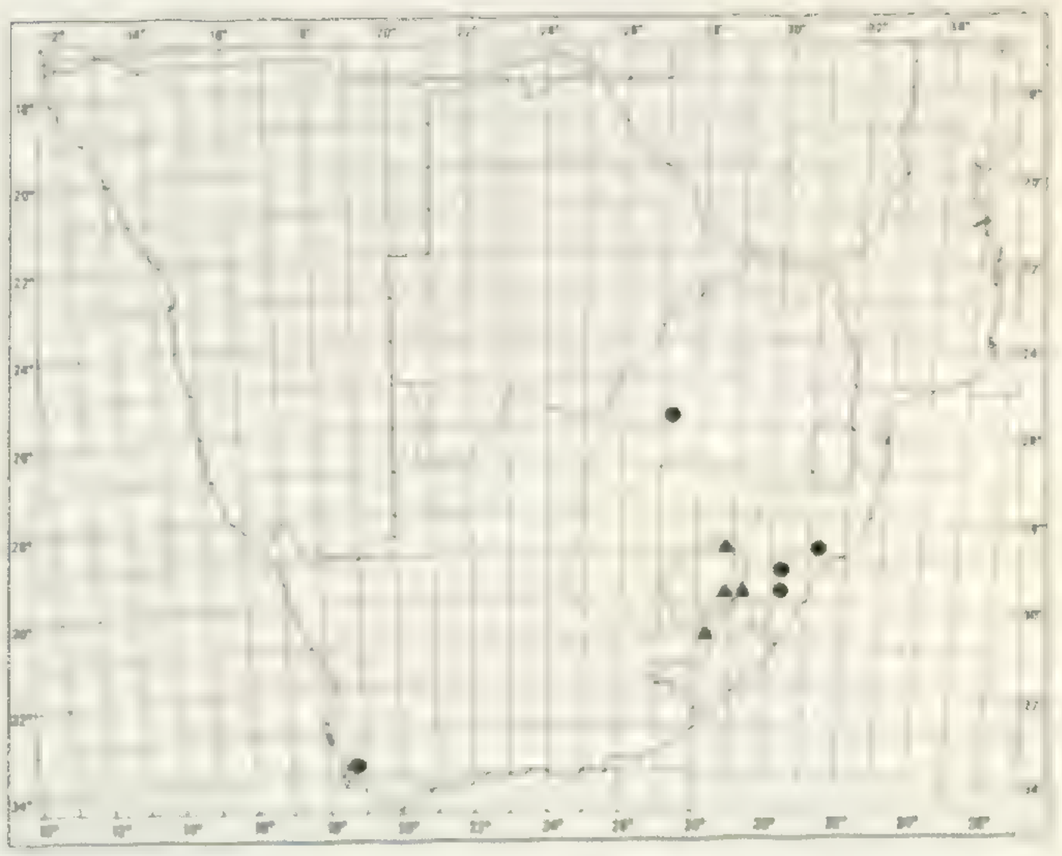
Plants small to medium-sized, loosely caespitose to caespitose, green above, yellowish brown or reddish brown below; terricolous or humicolous. *Stems* 3–15 mm tall, simple or branching by subperichaetial innovations, tomentose below; rhizoids reddish or reddish brown, papillose, tubers (80–)200–300 μm, red or red-brown. *Leaves* larger above, erect and slightly twisted dry, erect-spreading wet; lanceolate, oblong-lanceolate or elliptical, (0,8–) 1,0–2,0 (–2,2) mm long; apex acuminate; margins plane to recurved below, denticulate above; border generally absent. *Costa* mucronate to short-excurrent, occasionally reddish below, awn 0,1–0,3 mm long; in section subround, lamina inserted ventrally, ventral surface cells present, dorsal stereid band in 1–3 rows, dorsal surface cells incrassate, hydroids forming large gap between guide cells and stereid band. *Upper laminal cells* rhomboidal, thin-walled or occasionally incrassate, frequently narrower and incrassate towards margin, 40–68 (–98) μm long, 10–18 μm wide; basal cells rectangular to quadrate, thin-walled or incrassate, occasionally pitted. Propagulae not seen.

Dioicous. Perichaetia terminal, leaves lanceolate to narrowly triangular, margins recurved. *Seta* 12–28 mm long, yellowish to red; capsule pendulous, oblong-cylindrical or narrowly pyriform, yellowish brown, reddish brown to red, urn 1,0–2,2 mm long, neck wrinkled when dry, frequently curved, 0,8–1,2 mm long; exothecial cells irregular in shape, incrassate, smaller towards mouth, 1–3 rows at mouth transversely elongated; *peristome* double, exostome teeth narrowly oblong-acuminate, bordered, yellow, orange or red-brown below, hyaline above, minutely papillose, endostome segments tapered above, broadly perforated, cilia 2–3, nodose to appendiculate, basal membrane high, yellowish, minutely papillose; operculum conical, mammillate; calyptra cucullate; spores 11–14 μm, smooth to minutely granulose. Fig. 104: 10–18.

The species is found in northern America, Europe, New Zealand and southern Africa. In the Flora area *B. microerythrocarpum* is infrequently collected in the south-western Cape, Natal and central Transvaal. Map 141.

Vouchers: Sim PRE-CH3894, 3916; *Van Rooy* 628.

In comparison with *Bryum bicolor* and *B. radiculosum*, this species has longer and narrower capsules. Sterile specimens are sometimes difficult to distinguish from *B.*



MAP 141.— ● **Bryum microerythrocarpum**
▲ **Bryum caespiticium**

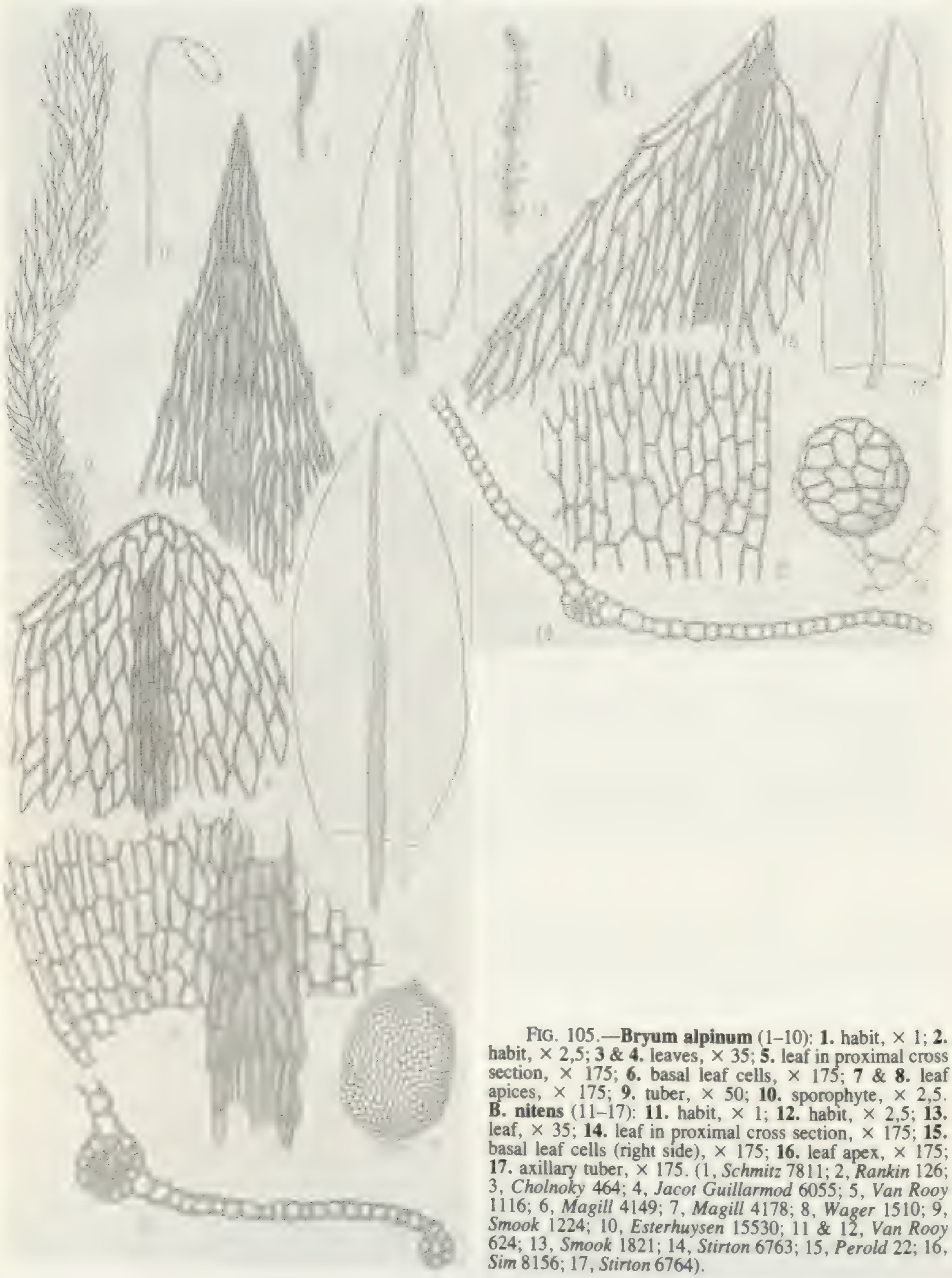


FIG. 105.—**Bryum alpinum** (1–10): **1.** habit, × 1; **2.** habit, × 2,5; **3 & 4.** leaves, × 35; **5.** leaf in proximal cross section, × 175; **6.** basal leaf cells, × 175; **7 & 8.** leaf apices, × 175; **9.** tuber, × 50; **10.** sporophyte, × 2,5. **B. nitens** (11–17): **11.** habit, × 1; **12.** habit, × 2,5; **13.** leaf, × 35; **14.** leaf in proximal cross section, × 175; **15.** basal leaf cells (right side), × 175; **16.** leaf apex, × 175; **17.** axillary tuber, × 175. (1, *Schmitz* 7811; 2, *Rankin* 126; 3, *Cholnoky* 464; 4, *Jacot Guillarmod* 6055; 5, *Van Rooy* 1116; 6, *Magill* 4149; 7, *Magill* 4178; 8, *Wager* 1510; 9, *Smook* 1224; 10, *Esterhuysen* 15530; 11 & 12, *Van Rooy* 624; 13, *Smook* 1821; 14, *Stirton* 6763; 15, *Perold* 22; 16, *Sim* 8156; 17, *Stirton* 6764).

bicolor. The lanceolate leaves with short-excurrent costae and the reddish tubers will help to identify specimens of *B. microerythrocarpum*.

6. **Bryum nitens** *Hook.*, Icon. Pl. 1: 19 (1836); Broth. in Natürl. PflFam. 10: 395 (1924); Ochi in J. Fac. Educ. Tottori Univ. 23: 62 (1972). Type: India.

Plants medium-sized, loosely caespitose to caespitose, green to yellowish green or reddish green above, green or yellowish brown to brown below; terricolous. *Stems* 5−35 mm tall, simple or branching by innovations, red to reddish brown, scarcely tomentose below; rhizoids yellowish brown or reddish brown, papillose, tubers axillary or on long rhizoids, 80−220 μm, cells generally protuberant, yellowish brown or reddish brown. *Leaves* distant below, crowded above to comose, concave, erect to erect-spreading dry, erect-spreading to widespreading wet; oblong-lanceolate, 1,2−2,2 mm long; apex acuminate; margins plane, entire to denticulate at apex; border absent. *Costa* weak, mucronate or occasionally percurrent, occasionally reddish; in section subround to round, laminal insertion ventral, guide cells occasionally absent, ventral stereid band absent, dorsal stereid band small, dorsal surface cells incrassate. *Upper laminal cells* long-rhomboidal, thin-walled, (55−)68−103(−125) μm long, 12−18 μm wide; basal cells abruptly broader below, subrectangular to rectangular or quadrate. Propagulae occasionally present in leaf axils.

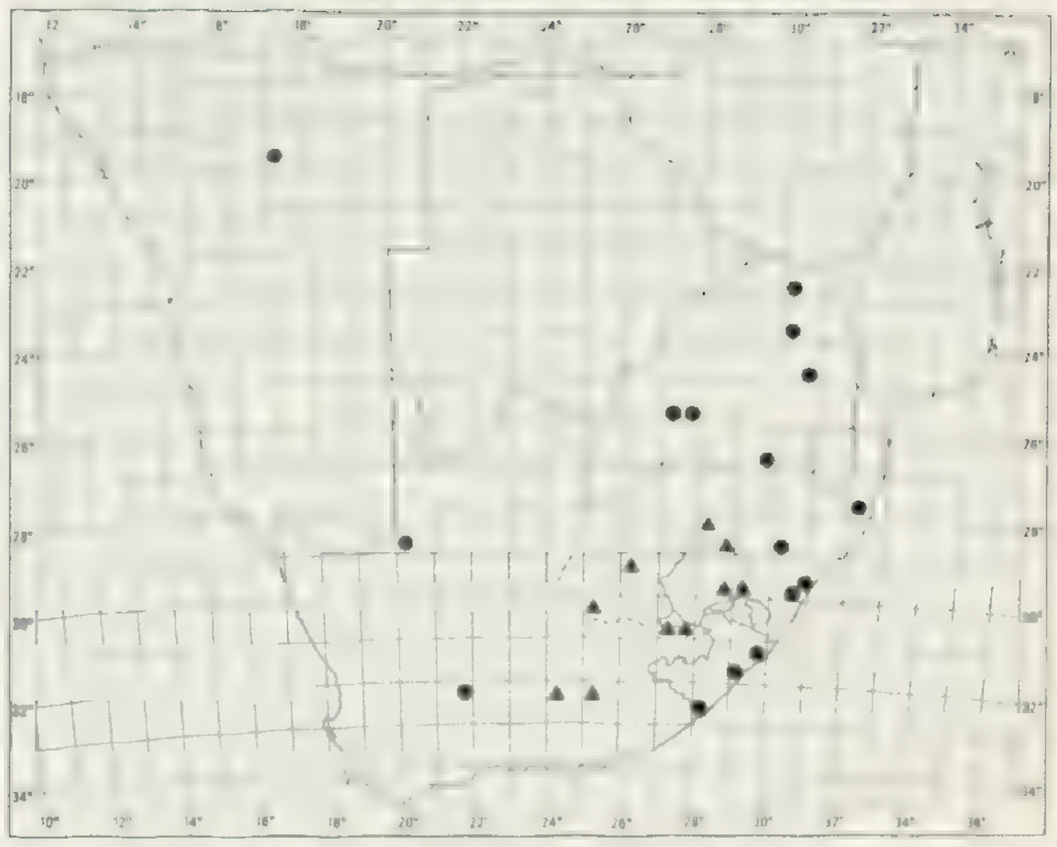
Dioicous. Sporophytes not seen. Fig. 105: 11−17.

Bryum nitens is known from India, southern and southeastern Asia, Japan, Oceania, Australia, Indian Ocean Islands, Madagascar and Africa. In southern Africa the species is occasionally collected on banks of rivers, streams and disturbed water courses in the northern, central and eastern Cape, Transkei, Natal, Zululand, central, southern, eastern and northern Transvaal and South West Africa/Namibia. Map 142.

Vouchers: *Cholnoky* 165; *De Winter & Giess* 6793a; *Perold* 22, 369; *Smook* 1821; *Stirton* 6764; *Van Rooy* 624, 957, 1709.

Bryum nitens will be recognized by the distantly spaced leaves on the lower stem, the concave leaves with weak costae, long-rhomboidal laminal cells, abruptly broader basal cells and plane margins. The presence of numerous axillary tubers with protuberant cells will also help to identify plants.

Some specimens (*Herman* 90 and *Van Rooy* 741) may be confused with *B. cellulare* because of their shorter leaves and laminal cells but they agree well in other characters with *B. nitens* (See note under *B. cellulare*).



MAP 142.— ● **Bryum nitens**
▲ **Bryum turbinatum**

7. **Bryum alpinum** *Huds.* ex *With.*, Syst. Arr. Brit. Pl. edn 4, 3: 824 (1801); Broth. in Natürl. PflFam. 10: 396 (1924); Ochi in J. Fac. Educ. Tottori Univ. 23: 59 (1972); Smith, Moss Fl. Brit. Irel. 414 (1978). Type: Europe.

Bryum afroalpinum Rehm. ex C. Müll. in Hedwigia 38: 73 (1899); Broth. in Natürl. PflFam. 10: 396 (1924). Syntypes: Orange Free State, Kadziberg, *Rehmann* 248, 248B (PRE!).

Bryum wilmsii C. Müll. in Hedwigia 38: 74 (1899); Broth. in Natürl. PflFam. 10: 397 (1924), fide Sim, Bryo. S. Afr. 332 (1926). Type: Transvaal, Spitzkop, Apr. 1887, *Wilms* in Herb. Jack.

Webera revoluta Sim, Bryo. S. Afr. 324 (1926), non *Pohlia revoluta* Card. (1909). *Pohlia simii* Schelpe in Mem. bot. Surv. S. Afr. 43: 7 (1979). Type: Transvaal, Houtbosch, *Rehmann* 566 (PRE, holo.!).

Plants medium-sized to large, caespitose, red to reddish green or green to yellowish green above, yellowish brown or reddish brown to brown below, frequently shiny; terricolous or saxicolous. *Stems* 5−55 mm tall, simple or branching by innovations, occasionally tomentose below; rhizoids red-brown, coarsely papillose, tubers rare, 140−300 (−1000) μm, red to red-brown. *Leaves* crowded or occasionally distant below, generally equidistant, about equal in size, appressed to erect when dry, erect to erect-spreading when wet, lanceolate to oblong-lanceolate, ovate-lanceolate or oblong to elliptical, frequently concave, 1−3 mm long; apex acuminate to rounded-obtuse, occasionally cucullate; margins plane to revolute, entire or

crenulate to denticulate at apex; border absent. *Costa* ending below apex to short-excurrent, reddish or yellowish to brown; in section subround to round, laminal insertion ventral, ventral surface cells incrassate, dorsal stereid band strong, stereids in 2–4 rows, dorsal surface cells incrassate or substereids, hydroids present between stereid band and guide cells. *Upper laminal cells* short-rhomboidal to linear-rhomboidal or vermicular, occasionally pitted, frequently incrassate, (32–)37–63(–98) μm long, (7–)10–15(–20) μm wide; basal cells rectangular to quadrate, frequently orange or yellow to brown, frequently pitted, occasionally bulging below, walls frequently thickened.

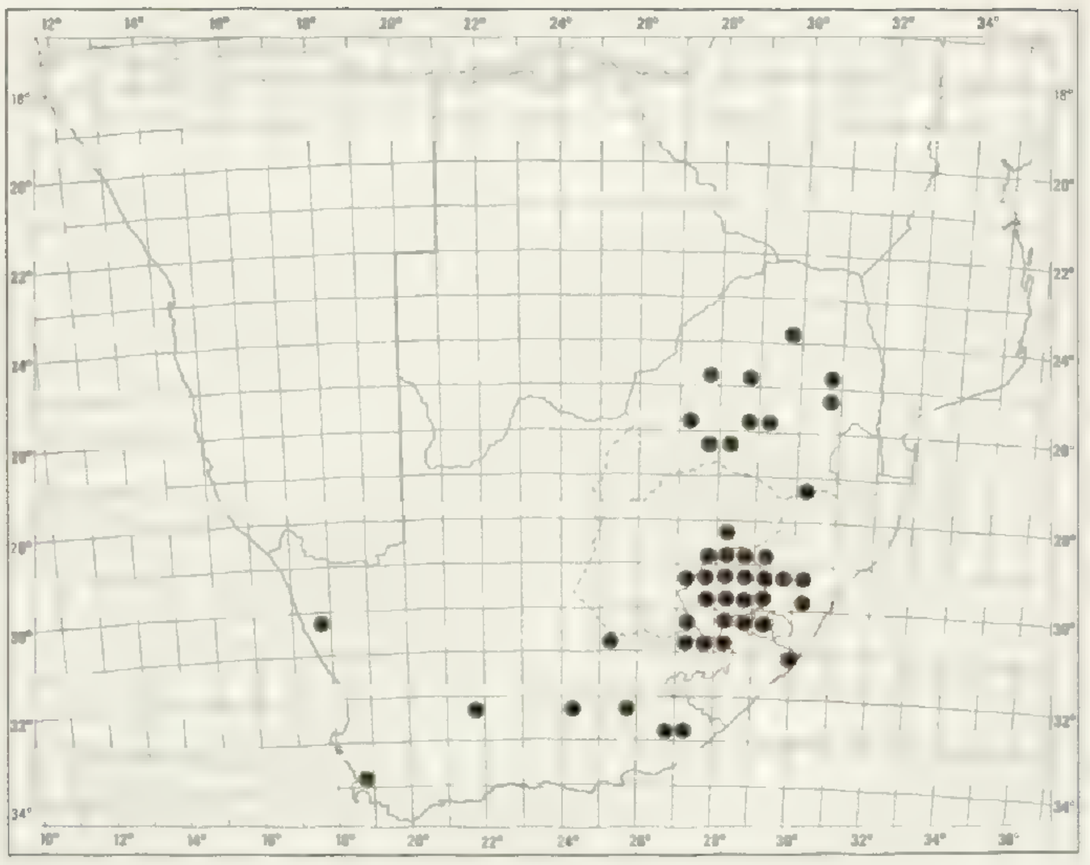
Dioicous, sporophytes rare. Perichaetia terminal; leaves lanceolate or triangular, 1,0–1,4 mm long, cells linear-rhomboidal to vermicular. *Seta* 13–40 mm long, red to reddish brown; capsule pendulous, clavate or pyriform, red to reddish brown, urn 1–2 mm long, neck frequently wrinkled when dry, 0,5–1,2 mm long; exothecial cells irregular in shape, incrassate, smaller towards mouth; *peristome* double, exostome teeth narrowly oblong-acuminate, yellowish brown below, hyaline above, minutely papillose, endostome segments tapered above, broadly perforated, cilia 2–3, nodose to appendiculate, basal membrane high, yellowish, minutely papillose; operculum mammillate; calyptra cucullate; spores 17–23 μm, minutely papillose. Fig. 105: 1–10.

Bryum alpinum has a cosmopolitan distribution. In southern Africa this species is frequently collected on wet soil and rock in the mountains of Lesotho, Natal and Orange Free State and occasionally in the southwestern, northwestern, central and eastern Cape, Transkei and southern, central, eastern and northern Transvaal. Map 143.

Vouchers: *Cholnoky* 464; *Deall & Killick* 98, 129, 142; *Esterhuysen* 15530; *Magill* 4139; *Russell* 3796; *Van Rooy* 11, 318, 674, 1108, 1472.

A broad species concept is employed here to accommodate the wide range of variation in leaf morphology displayed by southern African plants. It may be more correct to consider this a species complex. This concept of *B. alpinum* is likely to include the North American *B. miniatum* Lesq. and the European *B. muehlenbeckii* B.S.G., *B. mildeanum* Jur. and *B. gemmiparum* De Not.

Plants with lanceolate leaves, acuminate leaf apices, revolute leaf margins, linear-rhomboidal to vermicular laminal cells, thick cell walls and short excurrent costae, are frequently red to reddish green in colour. Plants with broader, oblong-lanceolate or elliptical leaves, rounded-obtuse leaf apices, generally plane leaf margins, rhomboidal to short-rhomboidal laminal cells with thinner walls and costae ending below the leaf apices, are green to yellowish green in colour. Intermediates are frequently found and variation sometimes occur among leaves of the same plant.



MAP 143.— ● **Bryum alpinum**

Narrow leaved plants may resemble species of *Pohlia* but *B. alpinum* will be recognized by its mucronate to short excurrent costa and the crowded leaves which are more or less evenly spaced along the stem. Plants with narrow leaves, short-excurrent costae and long-rhomboidal or vermicular, incrassate upper laminal cells (*Wager* PRE-CH106, 483), resembling the east African *B. stenophyllum* Dix. (pers. comm. Ochi, 1985), are treated here provisionally.

8. **Bryum capillare** *Hedw.*, Sp. Musc. 182 (1801); Syed in J. Bryol. 7: 269 (1973); Smith, Moss Fl. Brit. Irel. 401 (1978); Catcheside, Moss. South Austr. 257 (1980). Type: Europe.

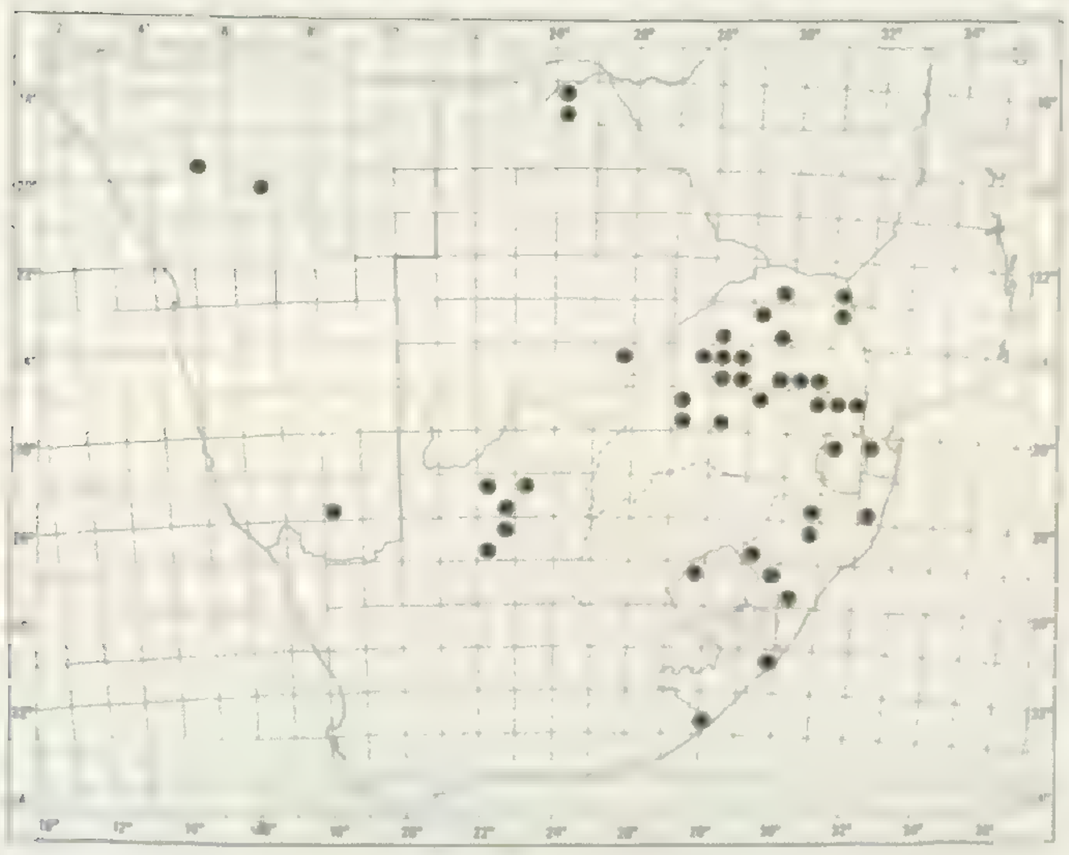
Plants small to medium-sized, caespitose, green or yellowish green or rarely reddish green above, brownish or occasionally reddish brown below; terricolous or saxicolous. *Stems* 1–7(–15) mm tall, simple or branching by innovations, occasionally tomentose below; rhizoids yellowish brown to reddish brown, papillose, tubers abundant, (180–)230–300(–450) μm, yellowish brown to brown. *Leaves* evenly spaced along stem or crowded above, larger above, spirally twisted around stem when dry, erect and slightly bent towards direction of twisting when wet; ovate to oblong or occasionally obovate-spathulate; (0,8–)1,0–1,6 mm long; apex acute to obtuse; margins plane above, plane to recurved below, entire to denticulate above; border generally inconspicuous, occasionally absent, cells in 1–2(–3) rows, sinuate. *Costa* cuspidate to aristate, awn (0,2–)

0,4−0,6(−0,7) mm long, generally smooth, mostly yellowish, infrequently reddish below; in section subround to round, laminal insertion ventral, ventral surface cells differentiated, dorsal stereid band strong, stereids in 2−4 rows, dorsal surface cells incrassate, hydroids present between stereid band and guide cells. *Upper laminal cells* rhomboidal to hexagonal, thin-walled, (26−)35−50(−63) μm long, (12−)15−19(−23) μm wide; basal cells quadrate to rectangular, infrequently pitted, infrequently reddish below. Filamentous gemmae absent.

Dioicous or synoicous. Perichaetia terminal, leaves narrowly lanceolate. *Seta* 15−25 mm long, yellowish above, reddish below; capsule pendulous, yellowish or brown, cylindrical to pyriform, urn 1,0−1,5 mm long, contracted below mouth when dry, neck wrinkled when dry, 0,9−1,4 mm long; exothecial cells irregularly rectangular, incrassate, smaller at mouth; *peristome* double, exostome teeth oblong-acuminate, finely papillose, endostome segments tapered above, broadly perforated, cilia 2−3, appendiculate, basal membrane high, minutely papillose; operculum conic, apiculate; calyptra not seen; spores small, 11−15 μm, pale yellow, smooth to granulose. Fig. 106: 1−8.

Bryum capillare is almost cosmopolitan and is found throughout the drier northern regions of the Flora area. It is frequently collected in Swaziland and Transvaal and occasionally in Transkei, Natal, Zululand, northern and eastern Cape, Botswana and South West Africa/Namibia. Map 144.

Vouchers: *Ellis* 3114; *Magill* 3642, 4929; *Retief & Herman* 17a; *Smook* 1461, 2714a; *Van Rooy* 744, 928, 1909; *Van Vuuren* 1725.



MAP 144.— ● **Bryum capillare**

Bryum capillare can be recognized when dry by leaves that are spirally twisted around the stem. The leaves are mostly ovate to oblong in shape, with rounded apices, inconspicuous and narrow borders, smooth to slightly denticulate margins and strongly excurrent costae forming smooth awns. Brown tubers are produced in abundance and sporophytes are rare. In some specimens (*Magill* 5074, *Russell* 2669, *Van Rooy* 709) the leaf border is weak to absent but the plants conform well in other characters to *B. capillare*.

The only fruiting specimen collected so far (*Schelpe* 2135), differs from sterile plants of *B. capillare* in being lax, with reddish green, oblong-spathulate leaves, distantly spaced along the red stem. The specimen is placed in *B. capillare* on the basis of the leaf and upper laminal cell length, the inconspicuous and narrow leaf borders, the entire to slightly denticulate leaf margins and the rounded leaf apices. No tubers could be found in the specimen.

For differences between *B. capillare* and *B. torquescens* see note under that species.

9. **Bryum torquescens** *Bruch* ex *De Not.*, Syll. no. 163 (1838); Bruch, Bryol. Eur. 4: 49 (1839); Sim, Bryo. S. Afr. 334 (1926) p.p.; Syed in J. Bryol. 7: 307 (1973); Smith, Moss Fl. Brit. Irel. 406 (1978); Catcheside, Moss. South Austr. 257 (1980). Type: Italy.

Bryum decursivum C. Müll. in Hedwigia 38: 70 (1899), fide Syed in J. Bryol. 7: 308 (1973). Type: Cape, Cape Town, *Rehmann* 246 (BM).

Bryum lonchopyxis C. Müll. in Hedwigia 38: 72 (1899). Type: Cape, Grahamstown, *MacOwan* s.n., June 1874 (GRA!).

Bryum porphyreothrix C. Müll. in Hedwigia 38: 70 (1899), fide Syed in J. Bryol. 7: 308 (1973). Type: Cape, Montagu Pass, Oct. 1875, *Rehmann* sub 103.

Bryum torquescentulum C. Müll. in Hedwigia 38: 71 (1899) fide Syed in J. Bryol. 7: 308 (1973). Type: Cape, Port Elizabeth, *Ecklon* s.n., Feb. 1830.

Bryum torquescentulum var. *nutans* C. Müll. in Hedwigia 38: 71 (1899). Type: Cape, Groenekloof, *Breutel* s.n.

Bryum aterrimum C. Müll. ex Sim, Bryo. S. Afr. 334 (1926). Type: Cape, between Knysna and Belvedere, *Rehmann* 235 (PRE!).

?Bryum acuminatum Sim, Bryo. S. Afr. 336 (1926), non (Hopp. & Hornsch.) B.S.G., Bryol. Eur. 4: 91 (1839). *Bryum simii* Schelpe in Mem. bot. Surv. S. Afr. 43: 7 (1979). Type: Natal, Cathkin, *Owen* 15 (PRE, holo.!).

Plants medium-sized, caespitose, green or reddish green above, brown to red-brown below; corticolous or saxicolous. *Stems* 1−15 (−20) mm tall, branching by subperichaetial innovations, innovations to 10 mm long, tomentose below; rhizoids red-brown, coarsely papillose, tubers (140−)170−280 μm, red. *Leaves* crowded above to comose, larger above, twisted to spirally twisted around stem when

FIG. 106.—**Bryum capillare** (1–8): **1.** habit, × 1; **2.** habit (dry), × 7; **3.** habit (wet), × 10; **4.** leaf, × 35; **5.** leaf in proximal cross section, × 175; **6.** basal leaf cells (right side), × 175; **7.** leaf apex, × 175; **8.** tuber, × 70. **B. torquescens** (9–15): **9.** habit, × 1; **10.** habit (wet), × 3,5; **11.** rhizoid, × 350; **12.** leaf, × 30; **13.** leaf in proximal cross section, × 175; **14.** laminal cells at upper right margin, × 175; **15.** rhizoid with tuber, × 88. (1–3 & 8, *Retief & Herman* 17a; 4, *Ellis* 3114; 5, *Magill* 4929; 6 & 7, *Van Vuuren* 1728; 9–11 & 14, *Crosby & Crosby* 8173; 12, *Magill* 3924; 13, *Cholnoky* 301; 15, *Van Rooy* 821).

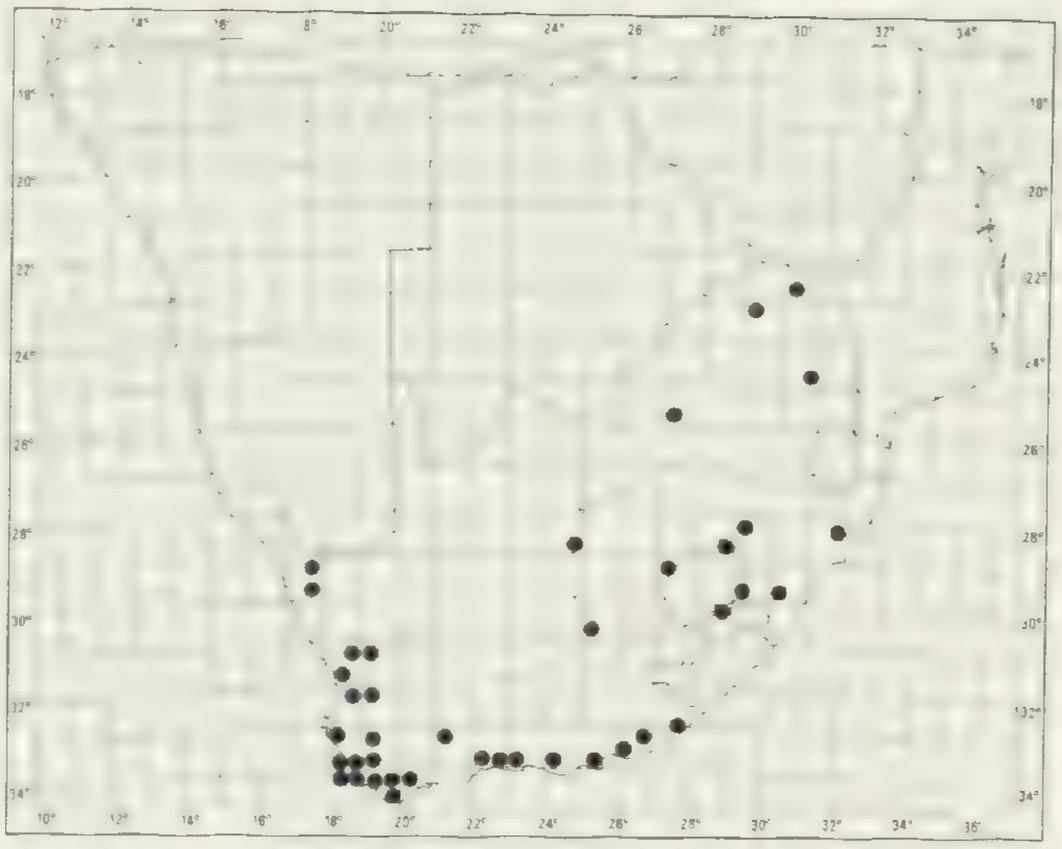
dry, patent when wet; elliptical to oblong-spathulate or oblong, (1,5−)2,0−3,0(−3,5) mm long; apex acute to acuminate; margins plane above, plane to recurved below, denticulate above; border (1−)2−3 cells wide, incrassate. *Costa* mucronate to aristate, awn (0,2−)0,4−0,6(−0,8) mm long, denticulate above, frequently reddish; in section round to subround, laminal insertion ventral, ventral surface cells present, dorsal stereid band strong, dorsal surface cells incrassate, hydroids present between guide cells and stereid band. *Upper laminal cells* rhomboidal to hexagonal, (45−)50−75(−88) μm long, (15−)16−22(−25) μm wide; basal laminal cells rectangular to quadrate, occasionally pitted, frequently reddish below. Filamentous gemmae absent.

Synoicous, autoicous or dioicous, frequently fruiting. Perichaetia terminal, leaves lanceolate to triangular. *Seta* (15−)20−30(−35) mm long, yellowish or reddish brown; capsule cernuous to pendulous, cylindrical, red or reddish brown, slightly contracted below mouth when dry, urn 1,4−2,7 mm long, neck occasionally wrinkled when dry; exothecial cells shorter above, in longitudinal rows, at mouth in 1−2 transverse rows; *peristome* double, exostome teeth oblong-acuminate, generally orange, finely papillose, endostome segments frequently broad below, abruptly narrowed above, broadly perforated, cilia 3, appendiculate, basal membrane high, finely papillose; operculum hemispherical, apiculate; calyptra cucullate; spores small, 12−14 μm, pale yellow, smooth to minutely papillose. Fig. 106: 9−15.

Bryum torquescens is known from Europe, the Middle East, Asia, North and South America, Australia, New Zealand and Africa. In southern Africa this species occurs mostly in the Fynbos Biome but also in forests, woodlands and more arid regions of the southwestern, northwestern, southern and eastern Cape. This species is also infrequently collected in the central Cape, eastern Orange Free State, Natal, Zululand and central, eastern and northern Transvaal. *B. torquescens* occasionally grows on bark in southern Africa but is mostly found on soil or rock. Map 145.

Vouchers: *Cholnoky* 125, 301; *Crosby & Crosby* 8173; *Magill* 3677, 6085, 6149, 6280, 6301; *Magill & Schelpe* 3947; *Van Rooy* 821.

Bryum torquescens has been treated as a synonym or a variety of *B. capillare* by many authors. It can be distinguished by the reddish green leaves, mostly oblong-spathulate in shape, with conspicuous borders and denticulate margins and awn. This species also has longer leaves and upper laminal cells than *B. capillare*. Numerous red tubers



MAP 145.— ● **Bryum torquescens**

are generally present on the rhizoids and sporophytes are frequently produced while *B. capillare* bears brownish tubers and is mostly sterile. *B. torquescens* has a southern distribution in the Flora area while *B. capillare* occurs in the drier northern regions.

Some specimens from Natal, the eastern Orange Free State and Transvaal (*Filter* PRE-CH13407; *Sim* 3928, PRE-CH9500; *Van Rooy* 575, 1539) consist of smaller plants with softer leaves, smaller upper laminal cells, weaker leaf borders, denticulation and costae, and red tubers with protuberant cells. The type of *B. simii* (*Owen* 15) also has softer leaves, narrow leaf borders, weak denticulation and shorter upper laminal cells, but the tubers are reddish brown without protuberant cells. The specimens are treated here provisionally.

10. **Bryum turbinatum** *(Hedw.) Turn.*, Musc. Hib. 127 (1804); Broth. in Natürl. PflFam. 10: 386 (1924); Lawton, Moss Fl. Pacific Northwest 174 (1971); Flowers, Moss. Utah 368 (1973); Smith, Moss Fl. Brit. Irel. 395 (1978); Crum & Anderson, Moss. E.N. Amer. 1: 551 (1981). Type: Europe.

Mnium turbinatum Hedw., Sp. Musc. 191 (1801).

Bryum radicale Rehm. ex Dix. in Sim, Bryo. S. Afr. 333 (1926). Type: Orange Free State, Bethlehem, *Rehmann* 245 (BM, holo.!).

Plants medium-sized, loosely caespitose or caespitose, green, yellow-green or reddish green above, brown and frequently shiny below; terricolous. *Stems* 4–45 mm tall, branching by subperichaetial innovations, red or red-brown, frequently tomentose below; rhizoids red-brown, papillose. *Leaves* crowded above, frequently distant below, erect and slightly twisted dry, erect-spreading to widespreading wet, generally concave; ovate, ovate-lanceolate

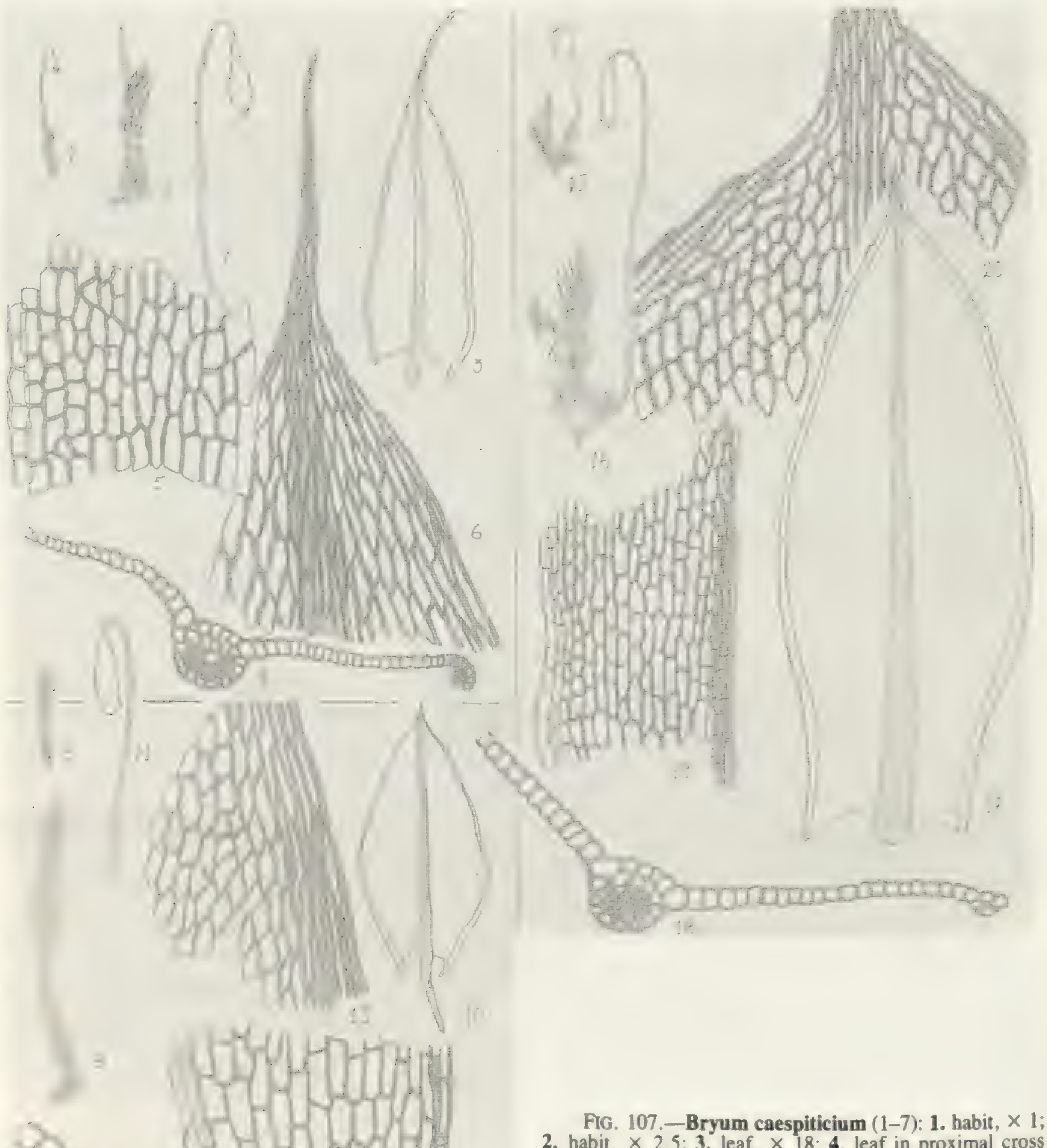


FIG. 107.—**Bryum caespiticium** (1–7): **1.** habit, × 1; **2.** habit, × 2,5; **3.** leaf, × 18; **4.** leaf in proximal cross section, × 88; **5.** basal leaf cells (left side), × 120; **6.** leaf apex, × 120; **7.** sporophyte, × 2,5. **B. pseudotriquetrum** (8–14): **8.** habit, × 1; **9.** habit, × 2,5; **10.** leaf, × 18; **11.** leaf in cross section, × 175; **12.** basal leaf cells (right side), × 175; **13.** laminal cells at upper right margin, × 175; **14.** sporophyte, × 2,5. **B. donianum** (15–20): **15.** habit, × 1; **16.** habit, × 2,5; **17.** leaf, × 35; **18.** leaf in proximal cross section, × 88; **19.** basal leaf cells (left side), × 70; **20.** leaf apex, × 175. (1–3, 5 & 7, *Russell* 3818; 4, *Magill* 4211; 6, *Meyer* 1046a; 8 & 9, *Magill* 5548; 10, 11 & 13, *Magill* 5646; 12, *Crosby & Crosby* 7832; 14, *Magill* 4593; 15, 16 & 18–20, *Garside* 6651; 17, *Magill* 6286).

or lanceolate, (0,8–)1,2–2,5 mm long; apex acuminate; margins rarely decurrent, plane above, plane or narrowly recurved below, entire or denticulate above; border indistinct, 1–4 cells wide, cells linear-rhomboidal to linear, incrassate, unistratose to bistratose. *Costa* mucronate, cuspidate or short excurrent, awn 30–260 μm long; in section round to subround, lamina inserted ventrally, ventral surface cells differentiated, dorsal stereid band strong, stereids in 2–4 rows, dorsal surface cells incrassate, hydroids present between stereid band and guide cells. *Upper laminal cells* rhomboidal, generally thin-walled, 42–88 μm long, 15–28 μm wide; basal cells quadrate to rectangular, frequently bulging, occasionally reddish below. Propagulae occasionally present, bud-like, axillary.

Dioicous. Perichaetia terminal, leaves lanceolate or narrowly triangular, margins recurved below, border indistinct. *Seta* 15–35 mm long, yellowish brown or reddish brown; capsule pendulous, shortly pyriform, frequently contracted below mouth when dry, yellowish brown to red-brown, urn 0,6–1,4 mm long, neck 0,8–2,0 mm long, wrinkled when dry; exothecial cells irregular in shape, incrassate, smaller towards mouth; *peristome* double, exostome teeth narrowly oblong-acuminate, yellow below, hyaline above, minutely papillose, endostome segments tapered above, broadly perforated, cilia 2–3, appendiculate, basal membrane high, yellowish, minutely papillose; operculum conical; calyptra not seen; spores 15–23 μm, pale, minutely granulose. Fig. 104: 19–26.

The species is known from North America, Europe, Asia, Japan, North and South Africa. In southern Africa, *B. turbinatum* is infrequently collected in the central and eastern Cape, Orange Free State, Lesotho and Natal. Map 142.

Vouchers: *Liebenberg* PRE-CH7647; *Lyle* PRE-CH9553; *Magill* 4229, 5907; *Potts* 2; *Russell* 3781; *Van Rooy* 2623, 2628.

Fruiting plants are easily recognized by the broadly pyriform capsule, frequently contracted below the mouth when dry. Vegetatively *B. turbinatum* can be distinguished from the closely related *B. pseudotriquetrum* by the indistinct, occasionally bistratose leaf borders, plane, rarely decurrent leaf margins, thinner walled laminal cells and broader leaf bases. The species may also be confused with *B. caespiticium* but that species has a longer excurrent costa and recurved to revolute leaf margins.

11. **Bryum caespiticium** *Hedw.* Sp. Musc. 180 (1801); Broth. in Natürl. PflFam. 10: 390 (1924); Lawton, Moss Fl. Pacific Northwest 167 (1971); Ochi in J. Fac. Educ. Tottori Univ. 23: 87 (1972); Smith, Moss Fl. Brit. Irel. 412 (1978); Catcheside, Moss. South Austr. 264 (1980); Crum & Anderson, Moss. E. N. Amer. 1: 558 (1981). Type: Europe.

Plants small to medium-sized, caespitose, yellowish green or reddish green above, brownish below; terricolous. *Stems* 5–15 mm tall, frequently branching by subperichaetial innovations, densely tomentose below, red to reddish brown; rhizoids red-brown, coarsely papillose, tubers absent. *Leaves* frequently in successive comal tufts, smaller below, frequently concave, imbricate to erect, slightly twisted when dry, erect to erect-spreading when wet; oblong-lanceolate to ovate-lanceolate or ovate-oblong (1,1–)1,5–2,3(–2,7) mm long; apex acuminate; margins generally recurved to revolute, entire to denticulate at apex; border indistinct. *Costa* long-excurrent, awn 0,2–0,8 mm long, entire to denticulate above, reddish below; in section subround to round, laminal insertion ventral, ventral stereid band absent, ventral surface cells present, dorsal stereid band strong, stereids in 3–5 rows, dorsal surface cells incrassate, hydroids present between guide cells and stereid band. *Upper laminal cells* rhomboidal, infrequently pitted, (35–)40–67(–73) μm long, (10–)12–15(–19) μm wide, narrower towards margin; basal cells rectangular, frequently reddish below, pitted.

Dioicous. Perichaetia terminal, leaves lanceolate to triangular. *Seta* 13–30 mm long, yellowish to reddish to reddish brown; capsule pendulous, oblong-cylindrical to clavate, yellowish to yellowish brown or reddish brown, frequently contracted below mouth when dry, urn 1–2 mm long, neck wrinkled when dry, 0,5–1,2 mm long; exothecial cells irregular rectangular, incrassate, smaller towards mouth, 1–3 rows at mouth transversely elongated; stomata on neck, phaneropore; *peristome* double, exostome teeth narrowly oblong-acuminate, yellowish, hyaline above, finely papillose, endostome segments tapering above, perforated, cilia 2–3, appendiculate, basal membrane high, yellowish or hyaline, smooth or minutely papillose; operculum conic, apiculate; calyptra cucullate; spores yellowish brown, 15–28 μm, minutely papillose. Fig. 107: 1–7.

Bryum caespiticium is almost cosmopolitan in distribution. In southern Africa this species is infrequently collected at high elevations in and around Lesotho. Map 141

Vouchers: *Magill* 4211, 4460, 4527, 4574a; *Meyer* 1046b; *Russell* 3818; *Van Zinderen Bakker* 452.

The plants are recognized by their caespitose habit and the oblong-acuminate leaves with reddish bases, recurved to revolute margins and long excurrent costae. See note under *B. turbinatum*.

12. **Bryum pseudotriquetrum** *(Hedw.) Gaertn., Meyer & Schreb.* in Oek. Techn. Fl. Wetterau 3: 102 (1802); Broth. in Natürl. PflFam. 10: 387 (1924); Ochi in J. Fac. Educ. Tottori Univ. 23: 82 (1972); Gangulee, Moss. E. India 4: 991 (1974); Scott & Stone, Moss. S. Austr. 282 (1976); Smith, Moss Fl. Brit. Irel. 411 (1978); Crum & Anderson, Moss. E. N. Amer. 1: 558 (1981). Type: Europe.

Mnium pseudotriquetrum Hedw., Sp. Musc. 190 (1801).

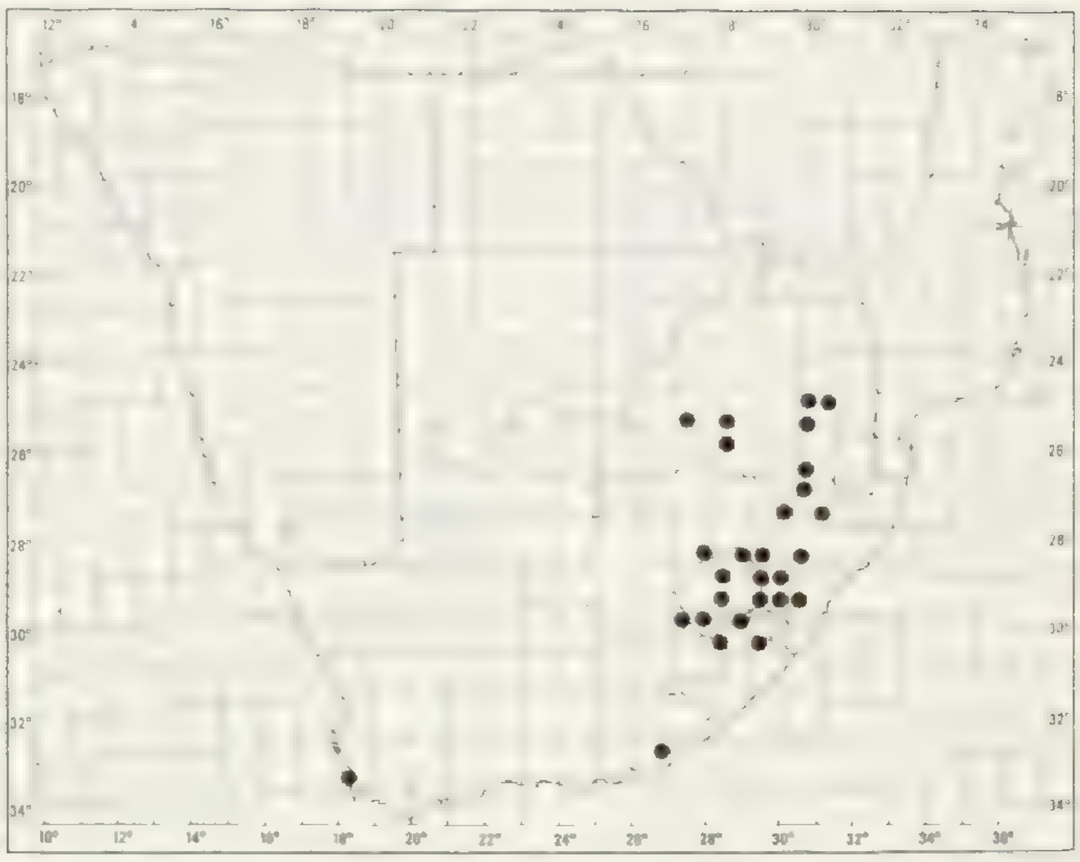
Bryum decurrens C. Müll. in Bot. Ztg 13: 751 (1855); Broth. in Natürl. PflFam. 10: 386 (1924). Type: Cape, Winterberg, *Ecklon* s.n., Jun. 1825 (BM!).

Bryum brachymeniaceum C. Müll. in Hedwigia 38: 71 (1899); Broth. in Natürl. PflFam. 10: 398 (1924); Sim, Bryo. S. Afr. 333 (1926). Type: Cape, Rondebosch, at tree roots, *Rehmann* 224 (PRE!).

Bryum aulacomnioides C. Müll. in Hedwigia 38: 72 (1899); Broth. in Natürl. PflFam. 10: 387 (1924); Sim, Bryo. S. Afr. 331 (1926). Type: Cape, Boschberg, Somerset East, *MacOwan* s.n., 1878 (GRA!).

Bryum aulacomnioides var. *limbatum* Sim, Bryo. S. Afr. 331 (1926). Syntypes: Cape, Cape Town, *Sim* 9534; Natal, Rosetta Farm, *Sim* 10,235; Litte Berg, *Owen* 40; Allerthorpe, *Sim* 10,236; Edgehill, *Sim* 10,237; Giants Castle, *Symons* s.n.; Impolweni Bridge, *Sim* 10,247; Giants Castle, *Sim* 10,245; Mont Aux Sources, *Sim* 10,246; Transvaal, Rosehaugh, *Sim* 8031 (all PRE!).

Plants medium-sized to large, caespitose, green to reddish green above, brownish or red-brown below; terricolous or saxicolous. *Stems* (3,0−)18−42 mm tall, frequently densely tomentose below, red, branching by innovations; rhizoids red-brown, coarsely papillose, tubers not seen. *Leaves* crowded above, frequently distant below, twisted to spirally twisted around stem dry, erect-spreading wet, elliptical or ovate-lanceolate or ovate, (0,8−)1,8−2,5(−4,2) mm long; apex acuminate; margins decurrent, frequently red, plane above, plane to revolute below, denticulate at apex; border strong, cells in (2−)4−8 rows, linear, incrassate, frequently red below. *Costa* percurrent to short-excurrent, yellowish or red; in section subround to round, laminal insertion ventral, ventral surface cells differentiated, dorsal stereid band strong, stereids in 2−4 rows, dorsal surface cells incrassate, hydroids present between stereid band and guide cells. *Upper laminal cells* short-rhomboidal to hexagonal, (22−)32−45(−68) μm long, (10−)17−22 (−25) μm wide, pitted; basal cells rectangular, frequently red below, pitted. Filamentous gemmae absent.



MAP 146.— ● **Bryum pseudotriquetrum**

Dioicous or synoicous, sporophytes infrequent. Perichaetia terminal, leaves lanceolate to triangular, 0,7−1,5 mm long, cells incrassate, elongate towards apex, border weak. *Seta* 16−32 mm long, yellowish or red-brown; capsule pendulous, straight, clavate, yellowish or brownish or red-brown, urn 1,2−2,8 mm long; neck wrinkled when dry, 0,9−2,0 mm long; exothecial cells irregular rectangular, incrassate, shorter above, in 1−2 transverse rows at mouth; *peristome* double, exostome teeth yellowish or orange, minutely papillose, endostome segments tapered above, broadly perforated, cilia 2−4, appendiculate, basal membrane high, smooth to minutely papillose; operculum conical, apiculate; calyptra not seen; spores 12−21 μm, smooth to granulose. Fig. 107: 8−14.

This cosmopolitan species occurs at higher altitudes in the southwestern and eastern Cape, Natal, Lesotho, eastern Orange Free State and southern, central and eastern Transvaal. Map 146.

Vouchers: *Arnold* 1270; *Deall & Killick* 72, 106, 115a; *Magill* 4145, 4593, 5646; *Smook* 886; *Van Rooy* 466, 1378.

B. pseudotriquetrum is most easily identified by the reddish green, generally decurrent and more or less distantly spaced leaves along the red stem. The leaves are mostly ovate or elliptical in shape, with a strong border and short-excurrent, reddish costa.

Ochi (1972) reported the specimen *Rehmann* 247 as *B. turbinatum* but the Rehmann specimen in PRE belongs here. For differences between *B. pseudotriquetrum* and *B. turbinatum* see note under *B. turbinatum*.

13. **Bryum donianum** *Grev.* in Trans. Linn. Soc. Lond. 15: 345 (1827); Broth. in Natürl. PflFam. 10: 399 (1924); Ochi in J. Fac. Educ. Tottori Univ. 23: 94 (1972); Smith, Moss Fl. Brit. Irel. 401 (1978). Type: Europe.

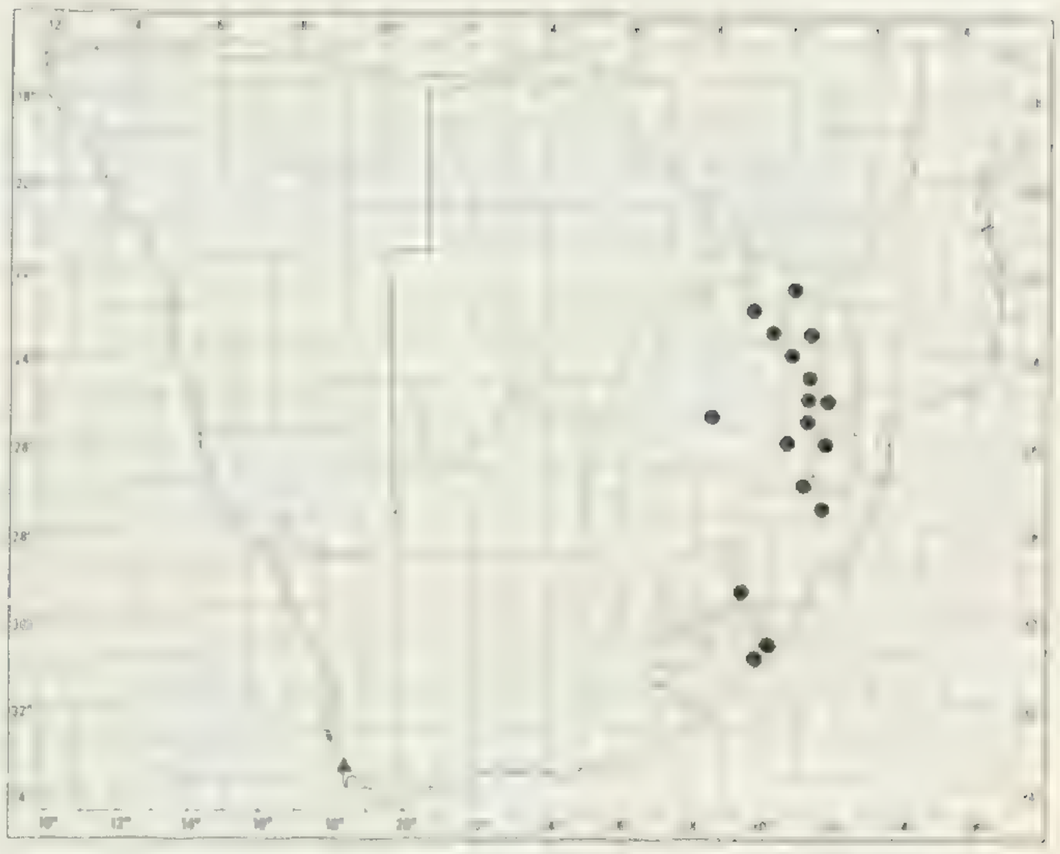
Plants medium-sized to large, caespitose, green or reddish green above, brown to red-brown below; terricolous. *Stems* 5−15 mm tall, branching by subperichaetial innovations, tomentose below; rhizoids red-brown, coarsely papillose, tubers absent. *Leaves* comose, larger above, erect and frequently twisted dry, erect-spreading wet; elliptical or obovate or obovate-lanceolate, 2,4−3,7 mm long; apex acuminate; margins plane above, recurved below, obscurely denticulate above; border strong, cells in 2−4 rows, incrassate or substereids, bi- to multistratose, yellowish or occasionally reddish, in section forming multicellular knob. *Costa* shortly excurrent, yellowish or reddish; in section subround to round, laminal insertion ventral, ventral surface cells present, dorsal stereid band strong, stereids in 3−5 rows, dorsal surface cells incrassate, hydroids present between stereid band and guide cells. *Upper laminal cells* rhomboidal, frequently pitted, in conspicuous rows, (27−)42−55(−62) μm long, (11−)15−20(−25) μm wide; basal cells rectangular, pitted, pink to reddish below. Filamentous gemmae absent.

Dioicous. Perichaetia terminal; leaves lanceolate to triangular, costa aristate. *Seta* 20−38 mm long, yellowish to red or reddish brown; capsule pendulous, straight or slightly curved, cylindrical or pyriform, contracted below mouth when dry, yellowish to red-brown, urn 2−3 mm long, neck wrinkled when dry, 1−3 mm long; exothecial cells irregular in shape, incrassate, shorter above; *peristome* double, exostome teeth oblong-acuminate, yellow to orange, minutely papillose, endostome segments tapered above, broadly perforated, cilia 2−3, appendiculate, basal membrane high, minutely papillose, operculum mammillate; calyptra not seen; spores round, 12−14 μm, pale yellow, essentially smooth. Fig. 107: 15−20.

New to southern Africa, *B. donianum* is also known from Europe, North Africa, the Middle East, eastern Asia and Macaronesia. In the Flora area only three collections have been made in the southwestern Cape. Map 147.

Vouchers: *Garside* 6651, 6654; *Magill* 6286.

This species could be confused with *B. torquescens* or *B. pseudotriquetrum* but the strong, distinct, bi- to multistratose border clearly separates it.



MAP 147.— ● **Bryum viridescens**
▲ **Bryum donianum**

14. **Bryum viridescens** *Welw. & Dub.*, Mém. Soc. Phys. Hist. Nat. Genève 21: 218 (1870); Broth. in Natürl. PflFam. 10: 400 (1924); Ochi in J. Fac. Educ. Tottori Univ. 23: 96 (1972). Type: Angola, Huilla, *Welwitsch* 28 (BM).

Bryum polytrichoideum sensu Sim, Bryo. S. Afr. 338 (1926).

Plants medium-sized to large, solitary or loosely caespitose, green above, reddish brown or yellowish brown below; terricolous or corticolous. *Stems* 5−35 mm tall, frequently branching by subperichaetial innovations, innovations to 15 mm tall, frequently tomentose; rhizoids reddish brown, papillose, tubers (200−)260−600(−800) μm, reddish brown or yellowish brown. *Leaves* comose, frequently in successive comal tufts, smaller below, appressed dry, erect-spreading and generally in a rosette wet; broadly oblong to obovate or infrequently spathulate, (1,6−)2,0−3,0(−3,8) mm long; apex obtuse or rarely acute; lamina frequently inflexed above; margins plane above, recurved in lower ⅓ to ¼, entire to crenulate to denticulate; border absent. *Costa* strong, aristate, awn 180−360 μm long, smooth to denticulate above; in section subround to round, ventral surface cells present, dorsal stereid band strong, stereids in 3−5 rows, dorsal surface cells incrassate to substereid, hydroids present between guide cells and stereid band. *Upper laminal cells* hexagonal, pitted, 17−25 μm long, (12−)15−23 μm wide; basal cells rectangular to quadrate, pitted.

FIG. 108.—**Bryum viridescens** (1–12): **1.** habit (dry), × 2; **2.** habit (wet), ×2,5 ; **3.** part of stem in cross section, × 175; **4.** rhizoid, × 175; **5.** leaf, × 18; **6.** leaf in proximal cross section, × 70; **7.** basal leaf cells (left side), × 70; **8.** leaf apex, × 175; **9.** rhizoid with tuber, × 35; **10.** perichaetial leaf, × 18; **11.** part of capsule mouth showing cells and peristome, × 70; **12.** spore, × 700. **B. canariense** (13–19): **13.** habit (dry), × 1; **14.** habit (wet), × 2,5; **15.** leaf, × 18; **16.** leaf in proximal cross section, × 70; **17.** basal leaf cells (left side), × 175; **18.** leaf apex (left side), × 175; **19.** tuber attached to rhizoid, × 175. (1 & 10–12, *Wits Univ.* PRE-CH12854; 2, *Hilliard & Burtt* 9977; 3, *Magill* 3736; 4 & 6, *Von Breitenbach* 145; 5, *Stirton* 9893; 7 & 8, *Herman* 76b; 9, *Von Breitenbach* 93; 13–18, *Oliver* 7238; 19, *Magill* 4091).

Dioicous. Perichaetia terminal; leaves narrowly oblong to triangular, 1−2 mm long, costa aristate. *Seta* 18−35 mm long, reddish brown or yellowish brown; capsule pendulous, oblong-cylindrical or infrequently pyriform, frequently contracted below mouth when dry, yellowish brown or reddish brown, urn 1,5−3,0 mm long, neck frequently wrinkled when dry, 1,0−1,2 mm long; exothecial cells irregular in shape, incrassate, smaller above; *peristome* double, exostome teeth narrowly oblong-acuminate, hyaline above, yellowish to yellowish brown below, finely papillose, endostome segments tapering above, broadly perforated, cilia 3−4, appendiculate, basal membrane high, yellowish, minutely papillose; operculum mammillate or rostellate; calyptra not seen; spores 12−20 μm, papillose. Fig. 108: 1–12.

The species is known from Angola and South Africa. In the Flora area *B. viridescens* is collected on soil and bark in forests, woodlands and grasslands of the central, eastern and northern Transvaal and Swaziland and rarely in Natal and Transkei. Map 147.

Vouchers: *Crosby & Crosby* 9211; *Herman* 81; *Magill* 3444, 3736, 4879; *Smook* 854a; *Stirton* 9893; *Van Rooy* 1382, 1878; *Vorster* 800.

The species is identified by the upper leaves arranged in a rosette, red-brown tomentum, absence of a leaf border, hexagonal laminal cells, inflexed upper leaf laminae and obtuse leaf apices.

The consistently shorter laminal cells and obtuse leaf apices will separate *B. viridescens* from the closely related *B. canariense*. *B. viridescens* is known from Transvaal and Swaziland and rarely from Natal and Transkei while *B. canariense* is known from the Cape, Orange Free State, Natal, Zululand and rarely from Transvaal.

Mohamed (1979) cited the specimen *MacLea* 558 in BM under *B. appressum* Ren. & Card. but duplicates in PRE and NH belong here. *B. appressum* is therefore excluded from the Flora area.

15. **Bryum canariense** *Brid.*, Sp. Musc. 3: 29 (1817); Broth. in Natürl. PflFam. 10: 400 (1924); Sim, Bryo. S. Afr. 338 (1926); Andrews in Grout, Moss Fl. N. Amer. 2: 239 (1940); Lawton, Moss Fl. Pacific Northwest 167 (1971); Smith, Moss Fl. Brit. Irel. 409 (1978). Type: Canary Islands, Tenerife Island, *Rudley* s.n., Bory St. Vinc. (B, holo.!).

Bryum mundtii C. Müll. in Bot. Ztg 17: 206 (1859); Broth. in Natürl. PflFam. 10: 401 (1924); Sim, Bryo. S. Afr. 337 (1926); Ochi in J. Fac. Educ. Tottori Univ. 23: 100 (1972). Syntypes: Cape: Grootvadersbosch, *Mundt* s.n.; Addo, *Ecklon* s.n., 1829; Genadendal, *Breutel* s.n.; Phillipstown ad Katrivier, *Ecklon* s.n.; Zwarte Hoogdene, *Ecklon* s.n., May 1823; Krakamma, *Ecklon* s.n., July 1832; Camps Bay, *Ecklon* s.n., Sept. 1824.

Bryum pervirens C. Müll. in Rabenh. Bryoth. Eur. 28: n. 1399 (1884). Type: Cape, Somerset East, Boschberg, no. 23 Hb. *MacOwen* (GRA!).

Bryum canariensiforme Dix. in Bull. Torrey bot. Club 43: 68 (1916); Broth. in Natürl. PflFam. 10: 400 (1924); Sim, Bryo. S. Afr. 336 (1926). Type: Cape, *Hobkirk* 928, July 25 1900.

Plants medium-sized to large, solitary or loosely caespitose to caespitose, green to yellowish green or olivaceous above, yellowish brown to brown below; terricolous or saxicolous. *Stems* 3−22 mm tall, frequently branching by subperichaetial innovations, innovations to 14 mm long, occasionally tomentose below; rhizoids red-brown, coarsely papillose; tubers rare, 200–760 μm, reddish brown or yellowish brown. *Leaves* comose, frequently semi-rosulate, frequently in successive comal tufts, distant and smaller to reduced below, appressed to erect or occasionally twisted dry, erect-spreading to widely spreading wet; broadly ovate to oblong, obovate-oblong or obovate, (1,7−)2,0−4,0(−6,0) mm long; apex acute to infrequently obtuse; lamina infrequently inflexed above; margins plane above, plane to recurved in lower ½ to ⅔, entire to crenulate or denticulate above; border absent or indistinct. *Costa* strong, aristate, awn 100–240 μm long, smooth to occasionally denticulate above, occasionally yellowish or reddish below; in section subround to round, ventral surface cells present, dorsal stereid band strong, stereids in 3−4 rows, dorsal surface cells incrassate to substereid, hydroids present between guide cells and stereid band. *Upper laminal cells* rhomboidal, occasionally pitted, frequently incrassate, frequently gradually narrowed towards margin, (35−)45−80(−100) μm long, (11−)12−20(−22) μm wide; basal cells rectangular to quadrate, pitted, occasionally yellow below.

Dioicous, frequently with sporophytes. Perichaetia terminal; leaves narrowly oblong-lanceolate to triangular, 1−3 mm long, costa aristate. *Seta* (13−)18−35(−42) mm long, yellowish or reddish to reddish brown; capsule pendulous, straight or slightly curved, oblong-cylindrical or narrowly pyriform, yellowish brown to reddish brown, urn 1,0−2,8 mm long, neck frequently wrinkled when dry, 0,6−1,5 mm long; exothecial cells irregular in shape, incrassate, smaller above; *peristome* double, exostome teeth narrowly oblong-acuminate, hyaline above, yellowish below, finely papillose, endostome segments tapering above, widely perforated, cilia 2−3, nodose to appendiculate, basal membrane high, minutely papil-

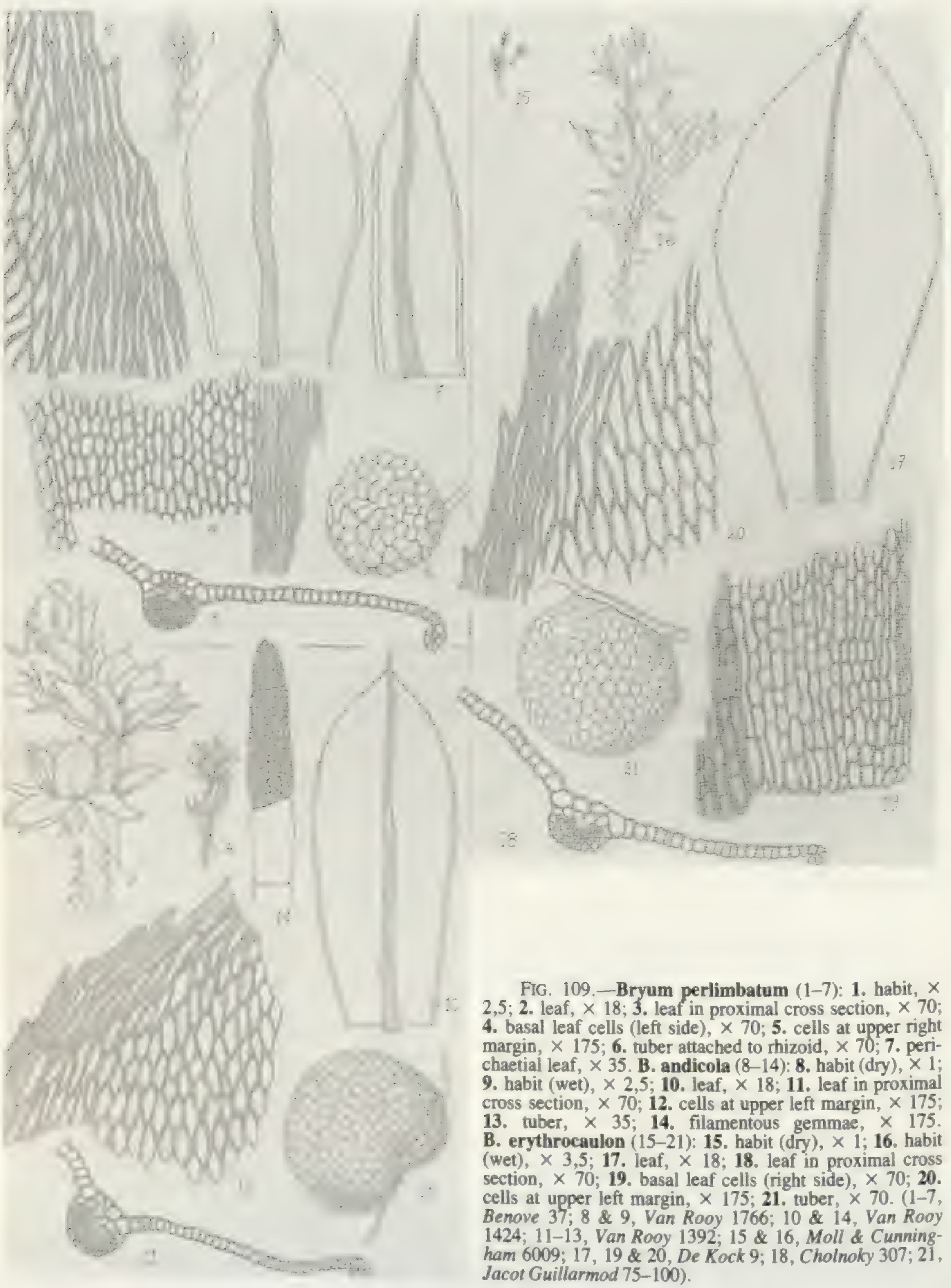
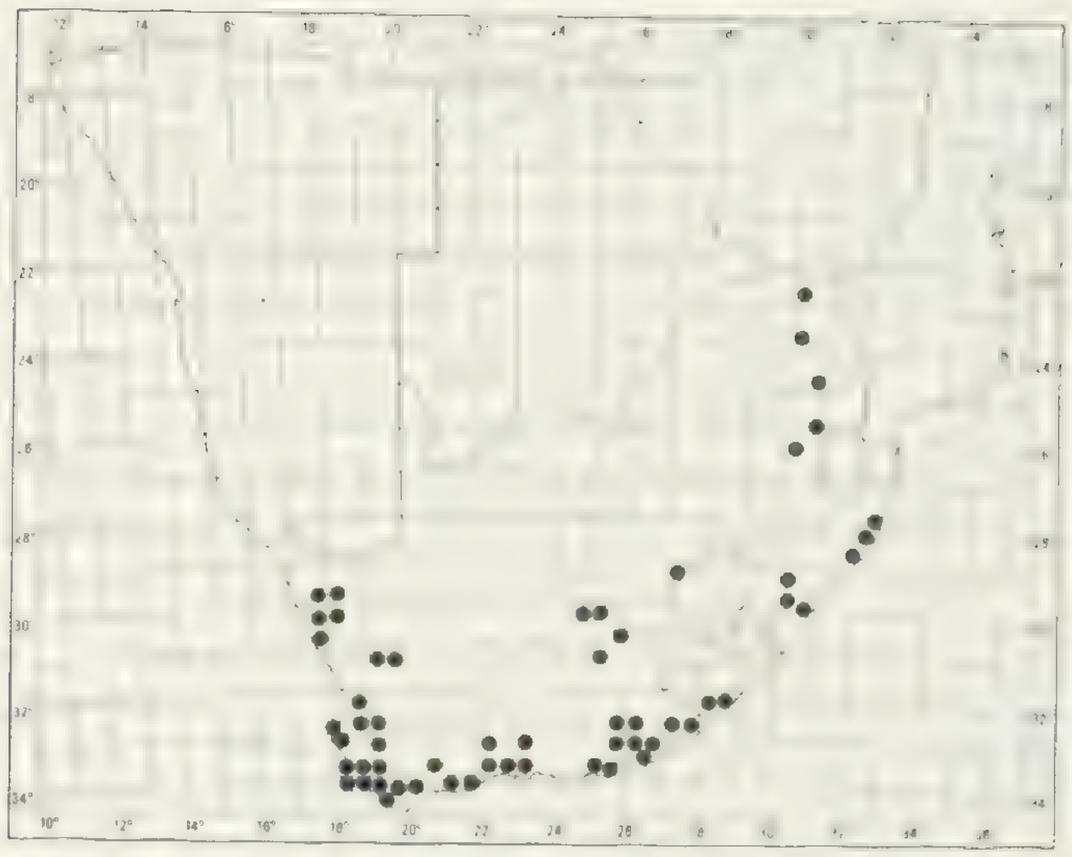


FIG. 109.—**Bryum perlimbatum** (1–7): **1.** habit, × 2,5; **2.** leaf, × 18; **3.** leaf in proximal cross section, × 70; **4.** basal leaf cells (left side), × 70; **5.** cells at upper right margin, × 175; **6.** tuber attached to rhizoid, × 70; **7.** perichaetial leaf, × 35. **B. andicola** (8–14): **8.** habit (dry), × 1; **9.** habit (wet), × 2,5; **10.** leaf, × 18; **11.** leaf in proximal cross section, × 70; **12.** cells at upper left margin, × 175; **13.** tuber, × 35; **14.** filamentous gemmae, × 175. **B. erythrocaulon** (15–21): **15.** habit (dry), × 1; **16.** habit (wet), × 3,5; **17.** leaf, × 18; **18.** leaf in proximal cross section, × 70; **19.** basal leaf cells (right side), × 70; **20.** cells at upper left margin, × 175; **21.** tuber, × 70. (1–7, *Benove* 37; 8 & 9, *Van Rooy* 1766; 10 & 14, *Van Rooy* 1424; 11–13, *Van Rooy* 1392; 15 & 16, *Moll & Cunningham* 6009; 17, 19 & 20, *De Kock* 9; 18, *Cholnoky* 307; 21, *Jacot Guillarmod* 75–100).



MAP 148.— ● **Bryum canariense**

lose, yellowish; operculum mammillate or rostellate; spores (12–)15–20(–23) μm, finely papillose. Fig. 108: 13–19.

The species is known from Europe, North America, Atlantic Islands and northern and southern Africa. In southern Africa *B. canariense* is frequently collected in the southwestern, northwestern, southern, eastern and central Cape, eastern Orange Free State, Transkei, Natal and Zululand and rarely in eastern and northern Transvaal. Map 148.

Vouchers: *Crosby & Crosby* 9263; *Esterhuysen* 27184; *Goldblatt* 2123; *Jacot Guillarmod* 7808; *Magill* 4096, 6183; *Oliver* 7238; *Smook* 3480, 4054; *Van Rooy* 528, 939.

The plants are recognized by their leaves in successive comal tufts and the absence of a well defined leaf border. In the majority of southern African plants the laminal cells gradually narrow and elongate towards the margin.

B. mundtii has longer leaves and laminal cells, longer and narrower cells along the leaf margin and stronger denticulate leaf margins than the type of *B. canariense*. Although the two extremes appear distinct, a continual gradation in leaf size and shape, cell size, differentiation of border cells and denticulation, from *B. canariense* to *B. mundtii*, is evident in southern African plants. Additional separating characters were not found. Differentiation of the border cells even varies among leaves on the same plant (*Oliver* 7239, *Barnard* SAM-46150).

Plants with narrow, incrassate border cells (*Schelpe* 7649, *Garside* 6513, *Van Rooy* 774) can be mistaken for *B. erythrocaulon* but the laminal cells of these specimens gradually narrow towards the margin and the border is not as well defined as in *B. erythrocaulon*.

Southern African plants of *B. canariense* are frequently fruiting but tubers are rarely found.

For differences between *B. canariense* and *B. virides-cens* see note under that species.

16. **Bryum erythrocaulon** *(Schwaegr.) Brid.*, Mant. Musc. 119 (1819); Mohamed in J. Bryol. 10: 428 (1979). Type: Mauritius, *Commerson* s.n. (G!).

Mnium erythrocaulon Schwaegr., Sp. Musc. Suppl. 1: 127 (1816).

Plants medium-sized to large, loosely caespitose, green or reddish green above, brown or red-brown below; terricolous or on charcoal. *Stems* to 20 mm tall, branching by innovations, tomentose below; rhizoids reddish brown, coarsely papillose, tubers large, (250–)350–550(–750) μm, yellow-brown. *Leaves* comose, frequently in successive comal tufts, larger above, erect or slightly twisted dry, erect-spreading and frequently rosulate wet; oblong to oblong-spathulate, 3,0–4,5 mm long; apex acute; margins plane above, recurved in lower ¾ to ⅔, dentate above; border 4–8 cells wide, cells sinuate, incrassate. *Costa* mucronate to shortly excurrent, denticulate above, frequently orange below; in section subround to round, laminal insertion ventral, ventral surface cells present, dorsal stereid band strong, stereids in 3–5 rows, dorsal surface cells incrassate, hydroids present between stereid band and guide cells. *Upper laminal cells* long-rhomboidal, frequently incrassate, pitted, (45–)52–73(–83) μm long, 12–19 μm wide, gradually narrowed towards border; basal cells rectangular, pitted, reddish or orange below. Filamentous gemmae absent.

Sporophytes not seen. Fig. 109: 15–21.

This species is known from Madagascar, Mauritius and southern Africa. In the Flora area *B. erythrocaulon* is infrequently collected in forests and woodlands of the southern, southwestern and eastern Cape, Transkei, Natal, Zululand and northern Transvaal. Map 149.

MAP 149.— ● **Bryum erythrocaulon**

Vouchers: *Cholnoky* 180b, 306, 307; *De Kock* 9; *Lambert* 12; *Moll & Cunningham* 6009; *Russell* 2672.

The leaves of *B. erythrocaulon* frequently have a reddish green tinge, are rosulate when wet and oblong to oblong-spathulate in shape. The upper laminal cells are long-rhomboidal, generally incrassate and gradually narrow towards the wide, distinctive border.

17. **Bryum perlimbatum** *Card.* in Bull. Herb. Boissier 2 (5): 1007 (1905); Ochi in J. Fac. Educ. Tottori Univ. 23: 105 (1972); Mohamed in J. Bryol. 10: 449 (1979). Type: Falkland Islands, Duperney Harbour, *Skottsberg* 236 (S).

Bryum herpetineuron Thér. in Bull. Mus. Hist. Nat. Paris 34: 117 (1928). Type: Natal, Port Natal, Ultima Esperanzo, *Benove* 37 (PC!).

Plants medium-sized, caespitose, green to yellowish green above, reddish or reddish brown below; terricolous. *Stems* 3−11 mm tall, simple or branching by subperichaetial innovations; rhizoids red-brown, densely papillose, tubers 150−550 μm, reddish brown. *Leaves* comose, larger above, erect and twisted dry, rosulate wet; oval or broadly oblong, frequently concave, 1,5−4,0 mm long; apex acute to obtuse; margins recurved to revolute in lower ⅔ to ¾, smooth to denticulate above; border 4−12 cells wide, cells narrow, incrassate. *Costa* aristate, awn to 0,3 mm long, frequently reddish below; in section round, laminal insertion ventral, ventral surface cells present, dorsal stereid band strong, stereids in 4−7 rows, dorsal surface cells incrassate, hydroids present between stereid band and guide cells. *Upper laminal cells* short-rhomboidal, pitted, (30−) 40−53 (−60) μm long, (15−) 17−20 (−23) μm wide; basal cells rectangular, pitted, reddish below. Filamentous gemmae absent.

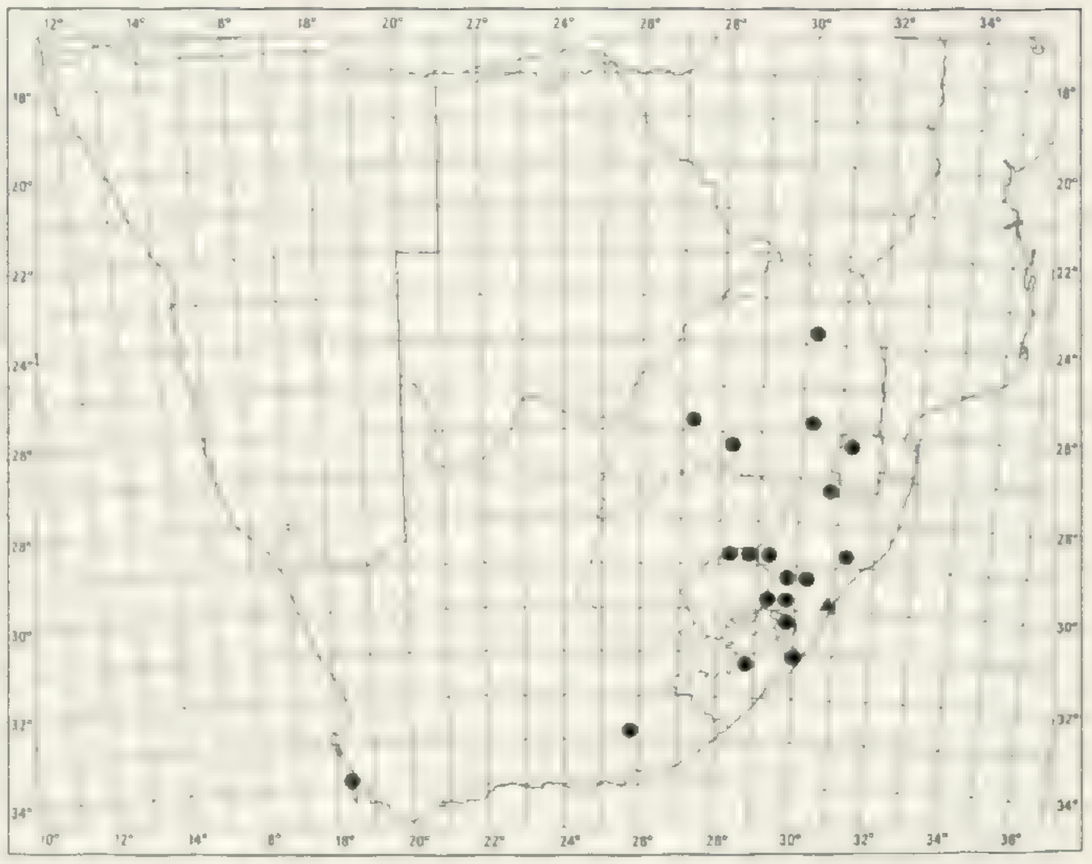
Dioicous. Sporophytes not seen. Fig. 109: 1−7.

Bryum perlimbatum occurs in New Zealand, South America, the Falkland Islands and southern Africa. Only one collection, the type specimen of *B. herpetineuron*, is known from the Flora area. Map 150.

Voucher: Type of synonym only.

This species can be recognized by the concave, broadly ovate or oblong leaves with wide borders.

18. **Bryum andicola** *Hook.* in Kunth, Syn. Pl. Aequin. 1: 58 (1822); Mohamed in J. Bryol. 10: 421 (1979). Type: Mexico.



MAP 150.— ● **Bryum andicola**
▲ **Bryum perlimbatum**

Bryum pumiliroseum Dix. in Trans. R. Soc. S. Afr. 8: 203 (1920); Sim, Bryo. S. Afr. 336 (1926). Syntypes: Cape, Hogsback, Tjumie, 1917, *Henderson* 326, 327, 337 (BOL!).

Plants medium-sized to large, loosely caespitose, green to yellow-green above, brown to reddish brown below; terricolous and corticolous. *Stems* 3−18 (−30) mm tall, simple or branching by innovations, tomentose below; rhizoids red-brown, densely papillose, tubers large, 525−1100 μm, reddish brown or yellow-brown. *Leaves* comose, frequently in successive comal tufts, larger above, twisted dry, rosulate above wet; elliptical to oblong or spathulate, (2,5−) 2,8−3,8 (−4,0) mm long; apex acute to occasionally obtuse; margins recurved to revolute in lower ⅔ to ¾, serrulate to serrate above; border 2−6 cells wide, cells sinuate, incrassate. *Costa* mucronate to excurrent as short awn, frequently denticulate above, awn to 0,3 mm long, reddish to reddish brown below; in section generally round, dorsal stereid band strong, stereids in 4−6 rows, dorsal surface cells incrassate, hydroids present between stereid band and guide cells. *Upper laminal cells* short-rhomboidal, frequently pitted, (25−) 33−45 (−50) μm long, (12−) 13−18 (−20) μm wide; basal cells rectangular to occasionally quadrate, pitted, frequently reddish to reddish brown below. Filamentous gemmae present in axils of comal leaves, highly branched, coarsely papillose, reddish brown to brown.

Dioicous, sporophytes infrequent. Perichaetia terminal, leaves oblong to lanceolate or triangular. *Seta* 15−20 mm long, yellowish to

reddish brown; capsule horizontal, pyriform, brown, slightly contracted below mouth when dry, urn 1,1–1,5 mm long, neck wrinkled when dry; exothecial cells irregularly rectangular, 4–7 rows at mouth smaller, quadrate, incrassate; *peristome* double, exostome teeth narrowly oblong-acuminate, to 0,4 mm long, finely papillose, endostome fragile, minutely papillose; operculum and calyptra not seen; spores round, 20–25 μm, finely papillose, light brown. Fig. 109: 8–14.

Bryum andicola is known from North, Central and South America and surrounding islands, East Africa and southern Africa. In the Flora area the species has been collected in forests and woodlands of the southwestern and central Cape, Transkei, Natal, eastern Orange Free State, Lesotho, eastern, southern, central and northern Transvaal and Swaziland. Map 150.

Vouchers: *Cholnoky* 102; *Magill* 3536; *Pienaar* 33; *Raven* 26126; *Van Rooy* 1424, 1589, 1627; *Wager* 1155.

This species is most easily identified by the conspicuous, reddish brown filamentous gemmae in the axils of the comal leaves. The leaves which are twisted when dry and rosulate when wet and the presence of large tubers will also help to distinguish *B. andicola*.

19. **Bryum pycnophyllum** *(Dix.) Mohamed* in J. Bryol. 10: 435 (1979). Syntypes: Zimbabwe [Rhodesia], Zimbabwe, *Sim* 8737; Umtali, *Eyles* 1725 (both PRE!).

Bryum truncorum (Brid.) Brid. var. *pycnophyllum* Dix. in S. Afr. J. Sci. 18: 321 (1922).

Bryum truncorum sensu Sim, Bryo. S. Afr. 337 (1926).

Plants medium-sized to robust, loosely caespitose to caespitose, green to yellowish green above, brownish below; terricolous or humicolous. *Stems* 5–45 mm tall, simple or branching by innovations, densely tomentose below; rhizoids red-brown or red, coarsely papillose, tubers generally absent. *Leaves* evenly spaced along stem or comose above, frequently in successive comal tufts, larger above, twisted dry, erect-spreading wet, elliptical to obovate, (2,5–) 3,0–6,0 mm long; apex acute; margins plane above, recurved in lower ½ to ⅗, denticulate to dentate above; border 2–5 cells wide, cells sinuose, incrassate, yellowish. *Costa* aristate, awn to 0,7 mm long, entire to denticulate above, yellowish; in section semi-circular or subquadrate to subrectangular, ventral surface cells present, dorsal substereid band weak to strong, dorsal surface cells incrassate or substereids, hydroids present between stereid band and guide cells. *Upper laminal cells* short-rhomboidal, frequently narrower and incrassate towards border, pitted, (35–) 40–63 (–78) μm long, (18–) 20–23 (–28) μm wide; basal cells rectangular, pitted. Filamentous gemmae absent.

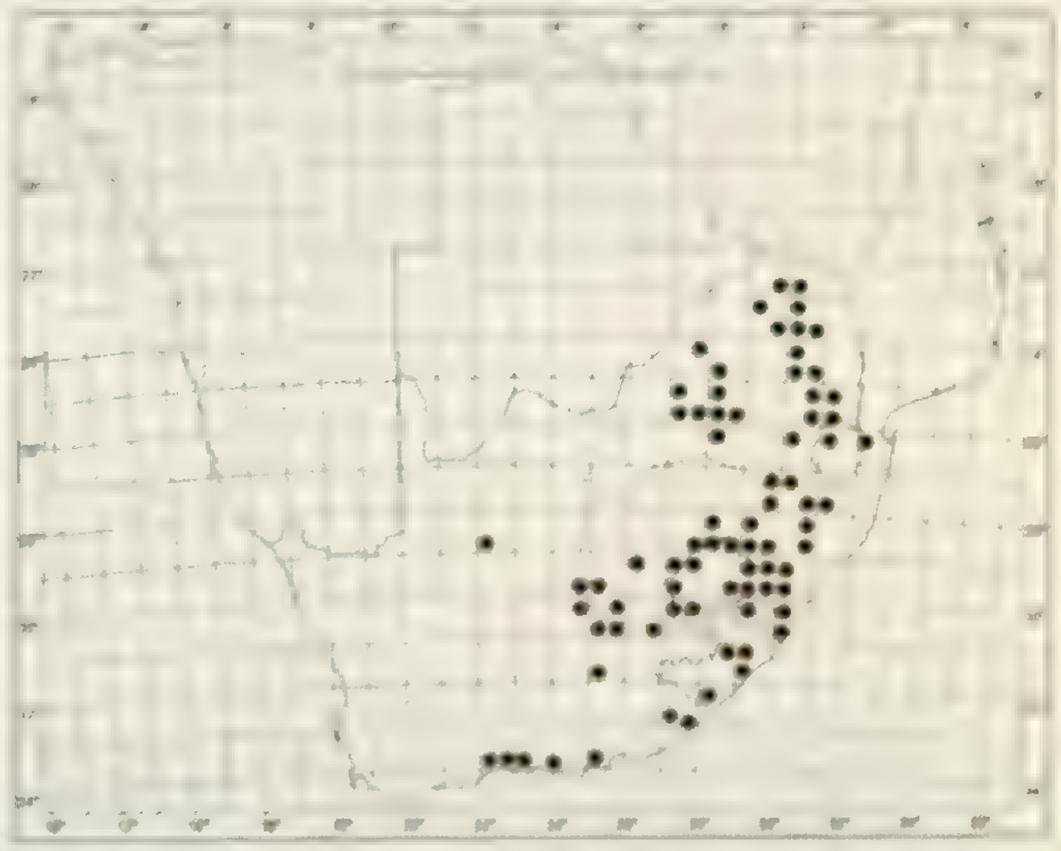
Dioicous. Perichaetia terminal, leaves narrowly oblong or triangular. *Seta* 15–30 mm long, yellowish to reddish brown; capsule horizontal, straight to curved, yellowish or red-brown, urn 2,2–3,0 mm long, neck wrinkled dry; exothecial cells irregularly rectangular, incrassate; *peristome* double, exostome teeth oblong-acuminate, 43–58 μm long, apex hyaline, finely papillose, endostome segments keeled, perforated, cilia 2–4, appendiculate, basal membrane high, finely papillose; operculum conic; spores 18–22 μm, pale yellow to brown, weakly papillose. Fig. 110: 1–7.

B. pycnophyllum is known from Africa south of the equator and has been collected in Tanzania, Zimbabwe and South Africa. In the Flora area this species is frequently collected in the southern, eastern, central and northern Cape, Transkei, Lesotho, Orange Free State, Natal, Zululand and in the southern, eastern, central and northern Transvaal. Map 151.

Vouchers: *Crosby & Crosby* 7501; *Magill* 3520, 3807, 4885; *Rankin* 216; *Smook* 2312; *Van Rooy* 73, 558, 745, 1041, 1357, 1602.

When dry, this species is recognized by the twisted leaves with yellowish borders and costae. The shape of the costa is generally subrectangular in cross-section, containing a large gap of collapsed hydroids and often weak dorsal stereid band. Filamentous gemmae and tubers are generally absent.

Tubers were found in two specimens, *Smook* 1411 from Natal and *Vahrmeijer* PRE-CH12682 from the Cape. The reddish tubers, 150–250 μm in diameter, resemble those of *B. torquescens* and plants of *B. pycnophyllum* in the two specimens might have been mixed with that species.



MAP 151.— ● **Bryum pycnophyllum**

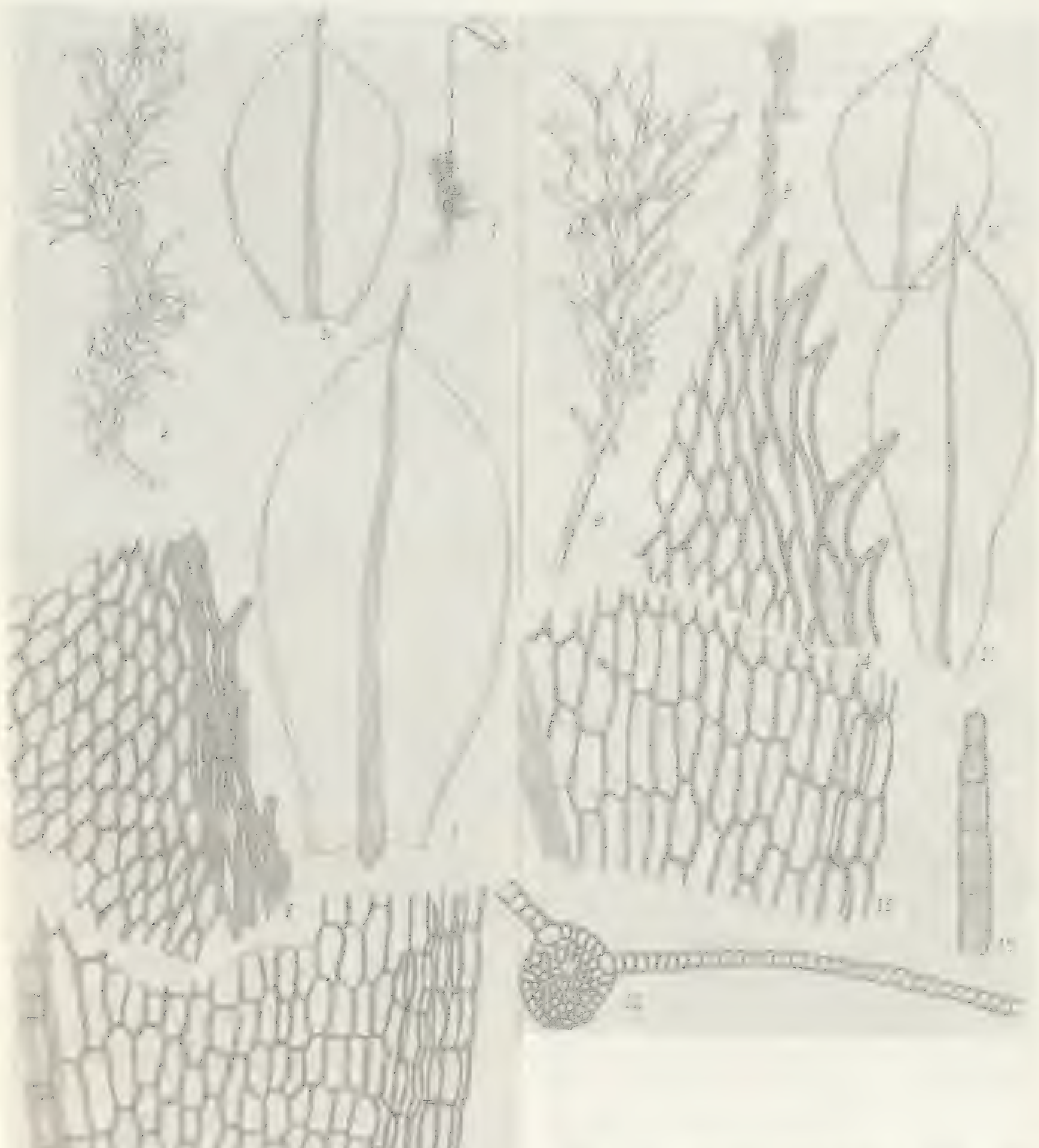


FIG. 110.—**Bryum pycnophyllum** (1–7): **1.** habit (dry), × 2; **2.** habit (wet), × 3,5; **3** & **4.** leaves, × 18; **5.** leaf in proximal cross section, × 70; **6.** basal leaf cells (right side), × 175; **7.** cells at upper right margin, × 175,. **B. aubertii** (8–15): **8.** habit (dry), × 2; **9.** habit (wet), × 3,5; **10** & **11.** leaves, × 12; **12.** leaf in proximal cross section, × 70; **13.** basal leaf cells (right side), × 175; **14.** cells at upper right margin, × 175; **15.** filamentous gemmae, × 175. (1, *Pegler* 1450; 2, *Van Rooy* 1702; 3, *Van Rooy* 548; 4, 5 & 7, *Smook* 1724a; 6, *Crosby & Crosby* 7742; 8 & 9, *Van Rooy* 1004a; 10, *Van Rooy* 350; 11, *Schelpe* 7580; 12 & 15, *Smook* 2549; 13 & 14, *Ruch* 2018).

More tubers must be found on the rhizoids of *B. pycnophyllum* before it can be reported as a tuber-bearing species.

Plants growing under more xeric conditions, at high altitudes and dry regions of the eastern Orange Free State, Lesotho, central and northern Cape (*Van Rooy* 548, 743; *Magill* 4635, 4637, 5839; *Smook* 2838) are generally smaller and have smaller, rounded leaves with weaker borders and denticulations. These plants still fall well within the wide range of variation in plant size and morphology displayed by *B. pycnophyllum*.

South African specimens of *B. pycnophyllum* were generally referred to *B. billardieri* Schwaegr. but that species bears large tubers, its leaves are not distinctly twisted when dry and it is not known from Africa. Specimens referred to the East African *B. voeltzkowii* Broth. are large facies of *B. pycnophyllum*.

20. **Bryum aubertii** *(Schwaegr.) Brid.*, Mant. Musc. 119 (1819); Ochi in J. Fac. Educ. Tottori Univ. 23: 118 (1972). Type: Insula Franciae, *Aubert* s.n. (G, holo.!).

Mnium aubertii Schwaegr., Sp. Musc. Suppl. 1 (2): 132 (1816). *Rhodobryum aubertii* (Schwaegr.) Thér. in Recueil Publ. Soc. Havraise Etud. Div. 89 (2): 128 (1922); Mohamed in J. Bryol. 11: 692 (1981).

Plants large to robust, loosely caespitose, green or reddish green above, dark-green or brownish below; terricolous or corticolous. *Stems* 5–60 mm tall, branching by innovations, frequently tomentose; rhizoids red-brown, papillose, tubers absent. *Leaves* equidistant to comose, successive comal tufts frequently present, twisted dry, erect-spreading wet; elliptical, oblong-spathulate or oblong-acuminate, 3–6 mm long; apex acute to acuminate; margins plane above, plane to recurved below, dentate to weakly spinose in upper ½ to ⅔; border absent or 1–3 (–4) cells wide, generally inconspicuous. *Costa* short-excurrent or occasionally ending below apex, yellowish or reddish, frequently weak above; in section subrectangular, ventral surface cells present, dorsal stereid band absent, dorsal cells incrassate to substereid, hydroids present between stereid band and guide cells. *Upper laminal cells* rhomboidal, frequently pitted, (46–) 55–75 (–88) μm long, 20–25 μm wide; basal cells rectangular, pitted, occasionally reddish. Filamentous gemmae frequently produced on leaf laminae, branched, yellowish brown or reddish brown, finely papillose.

Dioicous. Perichaetia terminal; leaves lanceolate to triangular, margins entire to dentate, border absent, costa aristate. Sporophytes not known. Fig. 110: 8–15.

Bryum aubertii is known from Madagascar, Réunion, Mauritius, central and southern Africa. In the Flora area this species is infrequently collected on soil, rock, humus or bark in forests and woodlands of Transkei, Natal, Zululand, eastern Orange Free State, Lesotho, southern, central and northern Transvaal and on Table Mountain in the southwestern Cape. Map 152.

Vouchers: *Crosby & Crosby* 7879; *Magill* 5712; *Retief* 733; *Smook* 1825, 2549; *Van Rooy* 121, 382, 1004a, 1665, 2226.

The species is recognized by the strongly toothed leaf margins, the weak leaf borders and the presence of filamentous gemmae on the leaf laminae. Southern African plants in general are smaller and have stronger toothed leaf margins than the type specimen. No filamentous gemmae could be found in the type specimen.

A specimen from Natal (*Van Rooy* 1527) has entire to weakly dentate leaf margins but agrees in all other characters with southern African specimens of *B. aubertii*.

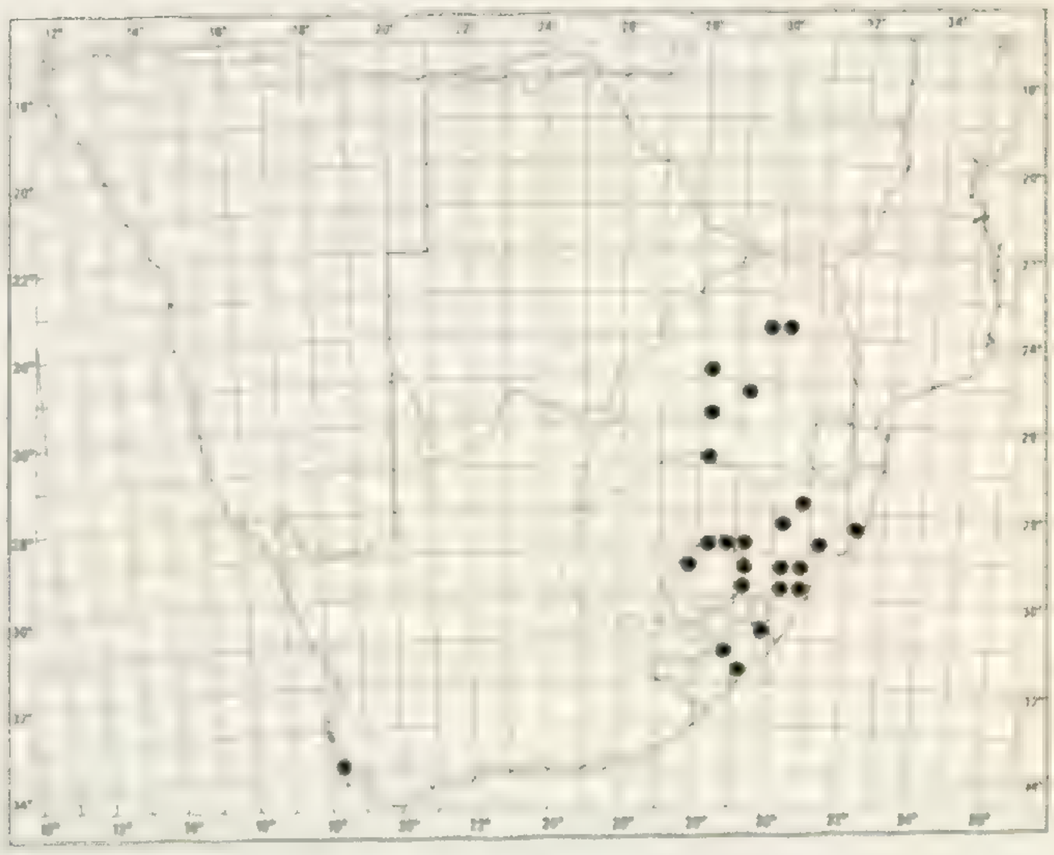
Although *B. aubertii* resembles species of *Rhodobryum*, southern African specimens are treated here because of their habit.

Insufficiently Known Species

Bryum condensatum Hampe in C. Müll., Bot. Ztg 16: 155 (1858); Sim, Bryo. S. Afr. 329 (1926). Type: Cape, Genadendal (probably collected by Breutel). The type has not been seen. Ochi (1972) treated the species provisionally as a synonym of *B. canariense* without citing a type specimen and it is not clear whether he has seen the type or not.

Bryum laxogemmaceum C. Müll. in Hedwigia 38: 75 (1899); Broth. in Natürl. PflFam. 10: 394 (1924). Type: Cape, Knysna, Esternek, *Rehmann* 253 (BM, iso.). The type has not been seen. Sim (1926) considered the species to be synonymous with *B. erythrocarpum* Schwaegr. Crundwell & Nyholm (1964) noted that the isotype in British Museum is mostly *Funaria hygrometrica* and the scanty, sterile *Bryum* material is indeterminable.

Bryum macleanum C. Müll. in Hedwigia 38: 74 (1899); Broth. in Natürl. PflFam. 10: 394 (1924). Type: Transvaal, Lydenburg, 1891, *MacLea* in Herb. Jack. The



MAP 152.— ● **Bryum aubertii**

type has not been seen. Sim (1926) treated the species as a synonym of *B. erythrocarpum* and Crundwell & Nyholm (1964) noted that the type specimen was probably destroyed with Müller's herbarium in Berlin.

Bryum pappeanum C. Müll. in Bot. Ztg 13: 752 (1885); Broth. in Natürl. PflFam. 10: 399 (1924). Type: Cape, *Pappe* s.n., 1838. The type has not been seen. Sim (1926) suggested that this species is synonymous with *B. capillare*, and Ochi (1972) also treated it as a synonym of *B. capillare*, without having seen the type.

Bryum polytrichoideum C. Müll. in Bot. Ztg 17: 206 (1859). Type: Cape, Rondebosch, *Pappe* s.n. (BM, syn.). The type has not been seen. Brotherus (1924) considered the species to be closely related to *B. canariense* and Sim (1926) confused it with *B. viridescens* without having seen the type. Ochi (1972) after seeing the type, treated it as a synonym of *B. capillare*.

Bryum prionotes Shaw in Cape Monthly Mag. 17: 319 (1878). Type: Cape, Katberg, s.l. Sim (1926) suggested that this is a synonym of *B. muehlenbeckii* B.S.G. without having seen the type. The Shaw collection was probably destroyed sometime after his death and attempts to locate specimens in southern African and European herbaria have been unsuccessful.

Bryum transvaaloalpinum C. Müll. in Hedwigia 38: 73 (1899). *Philonotis transvaaloalpinum* (C. Müll.) Broth. in Natürl. PflFam. 1: 598 (1909). Type: Transvaal, between Middelburg and Lydenburg, Dec. 1883, *Wilms* s.n. in Herb. Jack. The type has not been seen. Judging by the orginal description, it is likely that Sim (1926) is correct in referring this species to *Bryum alpinum*, although he had not seen the type.

9. RHODOBRYUM

Rhodobryum *(Schimp.) Limpr.*, Laubm. Deutschl. 2: 444 (1892); Broth. in Natürl. PflFam. 10: 402 (1924); Sim, Bryo. S. Afr. 339 (1926); Andrews in Grout, Moss Fl. N. Amer. 2: 241 (1940); Iwatsuki & Koponen in Acta Bot. Fenn. 96: 3 (1972); Gangulee, Moss. E. India 4: 1015 (1974); Smith, Moss Fl. Brit. Irel. 430 (1978); Crum & Anderson, Moss. E. N. Amer. 1: 575 (1981). Type species: *R. roseum* (Hedw.) Limpr.

Plants large to robust, solitary or gregarious; terricolous or humicolous. *Stems* frequently erect from rhizomes, to 70 mm tall, simple or branching by subperichaetial innovations, tomentose; in section with central strand, inner cortical cells thin-walled, outer cortical cells smaller, incrassate. *Leaves* loosely or tightly rosulate above, distant and reduced below, spathulate or obovate; margins denticulate to dentate above, border 1–4 cells wide. *Costa* ending below apex to short excurrent; in section with ventral cells in several rows, dorsal stereid or substereid band frequently small or absent, rarely large, hydroids differentiated. *Upper laminal cells* rhomboidal, basal cells rectangular.

Dioicous, frequently polysetaceous. Perichaetia and perigonia terminal. *Seta* long; capsule horizontal to pendulous, frequently curved, generally oblong-cylindrical, frequently contracted below mouth when dry, neck frequently wrinkled when dry; stomata phaneropore; annulus present; peristome double, exostome teeth 16, oblong-acuminate, trabeculate, hyaline above; endostome segments broadly perforated, keeled, cilia appendiculate, basal membrane high; operculum conic, frequently mammillate; calyptra cucullate; spores round, smooth to minutely papillose.

This genus contains approximately 48 species and is found from the temperate to the tropical zone on all the continents, excluding Antarctica. Tropical and subtropical Africa and South America are the two major centres of diversity.

Rhodobryum has many characters in common with the larger species of *Bryum*, but all or a combination of the following characters will usually place plants in this genus: 1. plants robust; 2. stems erect from rhizomes; 3. upper leaves arranged in distinct rosettes with lower leaves distant and reduced; 4. costa in cross-section with ventral cells in several rows and dorsal stereid or substereid band small or absent; 5. more than one sporophyte produced from a single perichaetium.

The costal anatomy has proved to be an important taxonomic character. Cross-sections were taken from the lower third of the leaf as the costa is frequently weak above.

The four species known from southern Africa are collected on humus-rich soil or litter in forests and dense, moist woodlands.

1 Costa in cross-section with dorsal stereid band absent; leaf margins generally plane.....3. *R. commersonii*
1 Costa in cross-section with dorsal stereid or substereid band; leaf margins recurved to revolute below:

2 Costa in section with dorsal stereid band large; rhizomes absent ..... 1. *R. keniae*
2 Costa in section with dorsal stereid or substereid band small; stems frequently erect from rhizomes:
3 Leaves obovate-spathulate, undulate when wet; costa in section with substereid band ..... 4. *R. umbraculum*
3 Leaves spathulate or oblong-spathulate, flat when wet; costa in section with stereid band ..... 2. *R. roseum*

1. **Rhodobryum keniae** *(C. Müll.) Broth.* in Natürl. PflFam. 10: 404 (1924). Type: Kenia [Kenya], *Von Höhnel* s.n., (H, iso.!).

Bryum keniae C. Müll. in Flora, Jena 73: 475 (1890); Ochi in J. Fac. Educ. Tottori Univ. 23: 112 (1972); Bizot & Pócs in Acta bot. hung. 25: 256 (1979).

Plants large to robust, gregarious, green or yellowish green above, brown or reddish brown below; terricolous or humicolous. *Stems* erect, 5−70 mm tall, frequently branching by subperichaetial innovations, brown or reddish brown, densely tomentose; rhizoids reddish brown, densely papillose. *Leaves* in successive rosettes through innovation, distant and reduced below, erect and twisted dry, widespreading wet; spathulate or oblong-spathulate, 6−11 mm long; apex acute to obtuse; margins recurved to revolute in lower ¾ to ⅔, denticulate to dentate above; border 2−3(−4) cells wide. *Costa* cuspidate or short excurrent, smooth, frequently yellowish or reddish below; in section round or subround, ventrally flat or rarely concave, laminal insertion ventral, ventral cells in 2 rows, dorsal stereid band strong, stereids in 3−5 rows, dorsal surface cells incrassate, hydroids present between stereid band and guide cells. *Upper laminal cells* rhomboidal to short-rhomboidal, 62−85(−100) μm long, 22−30(−35) μm wide, pitted; basal cells rectangular, pitted, frequently yellowish or reddish below. Filamentous gemmae subperichaetial on stem, reddish brown, coarsely papillose.

Dioicous, infrequently polysetaceous. Perichaetial, leaves triangular, apex acuminate, margins serrulate, costa aristate. *Seta* (27−) 30−35(−48) mm long, yellowish or reddish brown; capsule inclined to pendulous, yellowish brown or reddish brown, oblong-cylindrical, straight or slightly curved, slightly contracted below mouth when dry, urn 3−5 mm long, neck wrinkled when dry, 1−2 mm long; exothecial cells irregular in shape, incrassate, smaller at mouth; peristome teeth narrowly oblong-acuminate, yellowish brown below, hyaline above, finely papillose; endostome segments keeled, tapered above, broadly perforated, cilia 3, appendiculate, basal membrane high, yellowish, finely papillose; operculum conic, mammillate; calyptra not seen; spores round, 12−18 μm, weakly papillose. Fig. 111: 17−22.

Rhodobryum keniae occurs in submontane and montane forests of tropical and subtropical Africa. In southern Africa this species is infrequently collected on soil or humus in forests and dense woodlands of the eastern Cape, Natal, Swaziland and eastern and northern Transvaal. Map 153.

Vouchers: *Magill* 3533; *Manders* 67; *Obermeyer* PRE-CH11892; *Stirton* 1779; *Van der Schijff* 6184; *Van Rooy* 1222, 1586; *Von Breitenbach* 73.

This species is similar to those *Bryum* species with larger plants in the absence of rhizomes, the costal anatomy and the arrangement of leaves in successive rosettes. *R. keniae* is occasionally polysetaceous, the upper leaves are tightly rosulate and the lower leaves are distant and reduced. It has therefore provisionally been placed in *Rhodobryum* rather than *Bryum*.

Small, yellowish brown or reddish brown, papillose, subperichaetial filamentous gemmae are present on southern African plants.

2. **Rhodobryum roseum** *(Hedw.) Limpr.*, Laubm. Deutschl. 2: 445 (1892); Broth. in Natürl. PflFam. 10: 404 (1924); Sim, Bryo. S. Afr. 340 (1926); Andrews in Grout, Moss Fl. N. Amer. 2: 241 (1940); Nyholm, Moss Fl. Fenn. 259 (1954); Gangulee, Moss. E. India 4: 1016 (1974); Smith, Moss Fl. Brit. Irel. 430 (1978); Crum & Anderson, Moss. E. N. Amer. 1: 575 (1981). Type: Europe.

MAP 153.— ● **Rhodobryum keniae**

Mnium roseum Hedw., Sp. Musc. 194 (1801). *Bryum roseum* (Hedw.) Gaertn., Meyer & Scherb. in Oek. Techn. Fl. Wetterau 3: 104 (1802); Ochi in J. Fac. Educ. Tottori Univ. 23: 111 (1972).

Mnium spathulatum Hornsch. in Linnaea 15: 135 (1841). *Rhodobryum spathulatum* (Hornsch.) Pócs in Bizot & Pócs in Acta bot. hung. 25: 257 (1979); Koponen, Li & Zang in Ann. Bot. Fenn. 19: 78 (1982). Type: Cape, *Drège*, L no. 910. 115–97 (L, lecto.!), vide Touw in Lindbergia 9: 151 (1983).

Bryum leucothrix C. Müll. in Hedwigia 38: 69 (1899). *Rhodobryum leucothrix* (C. Müll.) Broth. in Natürl. PflFam. 10: 404 (1924). Type: Cape, Boschberg, *Mac-Owan* 20 (GRA, iso.!).

Plants large to robust, solitary or gregarious, green above, reddish brown below; terricolous or humicolous. *Stems* erect from rhizomes, 10–50 mm tall, simple or occasionally branching by subperichaetial innovations, red-brown, tomentose; rhizoids reddish brown, densely papillose. *Leaves* distant and reduced below, rosulate above, erect and twisted dry, spreading to squarrose wet; spathulate or oblong-spathulate, 7–14 mm long; apex acute or occasionally obtuse; margins recurved to revolute in lower ¾ to ⅔, denticulate to dentate above; border weak, 1–2(–3) cells wide. *Costa* short excurrent or occasionally ending below apex, tapering above; in section subround or semi-crescent shaped, ventrally flat to slightly concave, laminal insertion ventral, ventral cells in 4–6 rows, dorsal stereid band small, dorsal cells generally in 2 rows, hydroids present between stereid band and ventral cells. *Upper laminal cells* rhomboidal, (72–) 85–112(–137) μm long, (25–)30–35 μm wide, frequently pitted; basal cells rectangular, frequently pitted. Filamentous gemmae absent.

Dioicous, frequently polysetaceous. Perichaetia terminal; leaves lanceolate or triangular, margins entire to denticulate above, costa forming denticulate awn. *Seta* 27–42 mm tall, yellowish red or reddish brown; capsule pendulous, yellowish brown, oblong-cylindrical, slightly curved, slightly contracted below mouth dry, urn 2,5–5,0 mm long, neck short; exothecial cells irregular in shape, incrassate, smaller at mouth; *peristome* teeth narrowly ob-

MAP 154.— ● **Rhodobryum roseum**

long-acuminate, yellowish brown or orange, hyaline above, finely papillose, endostome segments keeled, tapered above, broadly perforated, cilia 2–3, appendiculate, basal membrane high, yellowish, minutely papillose; operculum conic, mammillate; spores round, 17–23 μm, minutely papillose. Fig. 111: 11–16.

This widely distributed species is known from Europe, Asia, Japan, northern and central America and eastern and southern Africa. In southern Africa it is infrequently collected on soil or humus in forests of the eastern and central Cape, Natal and eastern and northern Transvaal. Map 154.

Vouchers: *Esterhuysen* 20229a; *Filter* 1; *Junod* 4019; *Magill* 5520; *Rennie & Lambert* moss no. 24; *Van Rooy* 1171, 1492; *Young* 3016.

Rhodobryum roseum can be recognized by its tightly rosulate leaves, the spathulate or oblong-spathulate leaf shape, recurved to revolute lower leaf margins and the costal anatomy.

Although Iwatsuki & Koponen (1972) and Koponen *et al.* (1982) listed several characters to separate *R. roseum* from *R. spathulatum* (=*R. ontariense* Kindb.), these characters are not reliable for separation of specimens in southern Africa.

The lectotype of *Mnium spathulatum* at L, selected by Touw (1983), consists mostly of *Bryum aubertii*. However, a plant affixed to the sheet above the original handwriting, closely resembles *Rhodobryum roseum*. The original collection could have been mixed and we therefore follow Ochi (1972) in including *R. spathulatum* in the synonymy of *R. roseum*.

FIG. 111.—**Rhodobryum umbraculum** (1–10): **1.** habit (dry), × 1; **2.** habit (wet), × 1; **3.** stem in cross section, × 42; **4.** leaf, × 5; **5.** leaf in proximal cross section, × 175; **6.** cells at upper right margin, × 175; **7.** leaf apex, × 42; **8.** perichaetial leaf, × 5; **9.** sporophyte, × 5; **10.** part of capsule mouth showing cells, peristome and spores × 70. **R. roseum** (11–16): **11.** habit (wet), × 1; **12.** leaf, × 5; **13.** leaf in proximal cross section, × 175; **14.** cells at upper right margin, × 175; **15.** leaf apex, × 42; **16.** perichaetial leaf, × 5. **R. keniae** (17–22): **17.** habit, × 1; **18.** leaf, × 5; **19.** leaf in proximal cross section, × 175; **20.** cells at upper right margin, × 175; **21.** leaf apex, × 42; **22.** perichaetial leaf, × 5. (1–3 & 6–10, *Crosby & Crosby* 7905; 4 & 5, *Kluge* 1004; 11–16, *Magill* 5520; 17–21, *Magill* 3537; 22, *Obermeyer* PRE-CH11893).

FIG. 112.—**Rhodobryum commersonii: 1.** habit (wet), × 1,5; **2.** leaf, × 5; **3.** costa in proximal cross section, × 175; **4.** basal leaf cells (right side), × 88; **5.** cells at upper left margin, × 175; **6.** leaf apex, × 42; **7.** perichaetial leaf, ×5. (1 & 7, *Junod* 13; 2–6, *Smook & Phelan* 664).

3. **Rhodobryum commersonii** *(Schwaegr.) Par.*, Ind. Bryol. 115 (1898); Broth. in Natürl. PflFam. 10: 404 (1924); Sim, Bryo. S. Afr. 340 (1926); Mohamed in J. Bryol. 11: 691 (1981). Type: Réunion, *Commerson* H-89 (H, iso.).

Mnium commersonii Schwaegr., Sp. Musc. Suppl. 1 (2): 134 (1816). *Bryum commersonii* (Schwaegr.) Brid., Mant. Musc. 119 (1819); Ochi in J. Fac. Educ. Tottori Univ. 23: 121 (1972).

Plants large to robust, gregarious, green above, brownish below; terricolous or humicolous. *Stems* frequently erect from rhizomes, to 50 mm tall, simple or occasionally branching by subperichaetial innovations, red-brown, tomentose below; rhizoids reddish brown, papillose. *Leaves* crowded or loosely rosulate above, distant and smaller below, erect dry, widespreading to squarrose wet, undulate and slightly twisted dry, flat to weakly undulate above wet, obovate, 7–15 mm long; apex acute to obtuse; margins plane above, plane to occasionally recurved below, denticulate to dentate above; border 1–3 cells wide. *Costa* subpercurrent to short excurrent, frequently reddish; in section subrectangular, laminal insertion ventral, ventral cells in 3–5 rows, dorsal stereid band absent, dorsal cells thin-walled, occasionally incrassate dorsally, hydroids present in centre of costa. *Upper laminal cells* rhomboidal to hexagonal, pitted, (40–)67–100(–135) μm long, (30–)33–45(–58) μm wide; basal cells rectangular, pitted, occasionally reddish below. Filamentous gemmae absent.

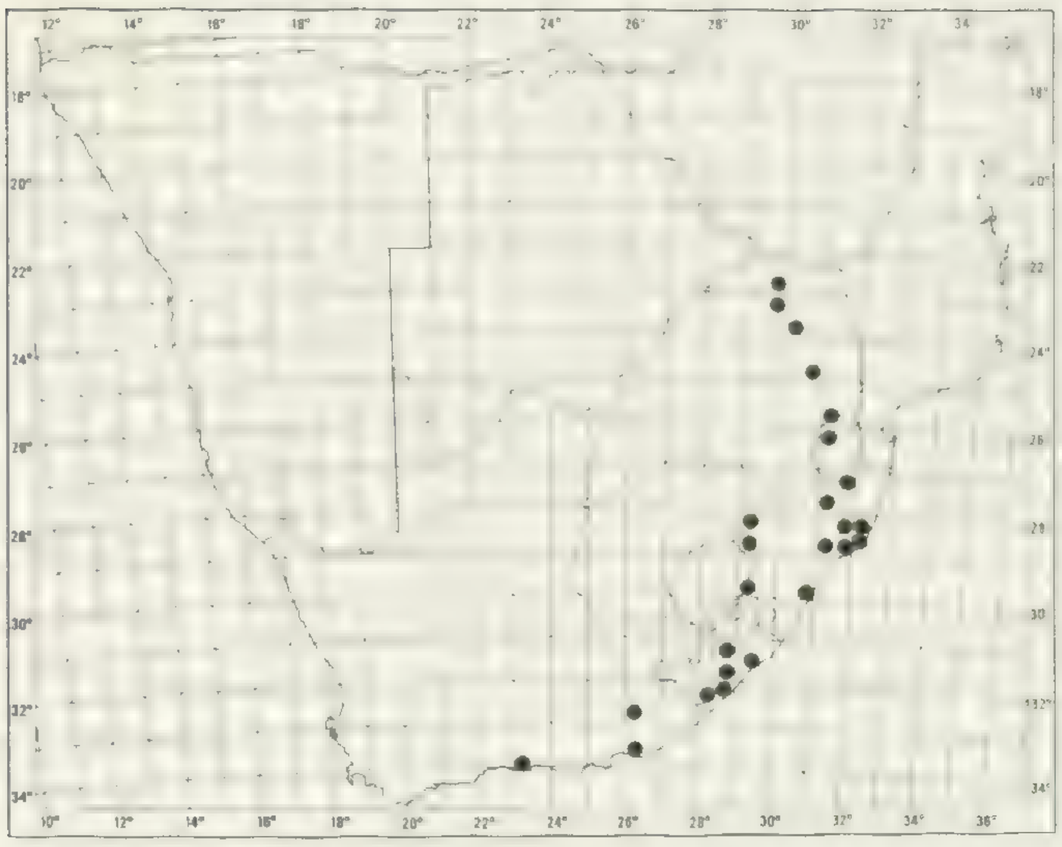
Dioicous, infrequently polysetaceous. Perichaetia terminal, leaves lanceolate or triangular. *Seta* 30–57 mm long, yellowish or reddish or reddish brown; capsule horizontal to pendulous, curved, oblong-cylindrical, contracted below mouth dry, brown or reddish brown, urn 4,5–6,0 mm long, neck wrinkled dry, 1,2–2,0 mm long; exothecial cells irregular in shape, smaller at mouth, incrassate; *peristome* teeth oblong-acuminate or lanceolate, yellowish brown below, hyaline above, trabeculate, finely papillose, endostome segments keeled, broad below, tapered above, broadly perforated, cilia 2, appendiculate, basal membrane high, yellowish, minutely papillose; spores round, 14–18 μm, minutely papillose. Fig. 112.

Rhodobryum commersonii occurs in India, Madagascar, Comoro Islands and eastern, central and southern Africa. In the Flora area this species is collected on humus or soil in forests and dense woodlands of the southern and eastern Cape, Transkei, Natal, Zululand, Swaziland and eastern and northern Transvaal. Map 155.

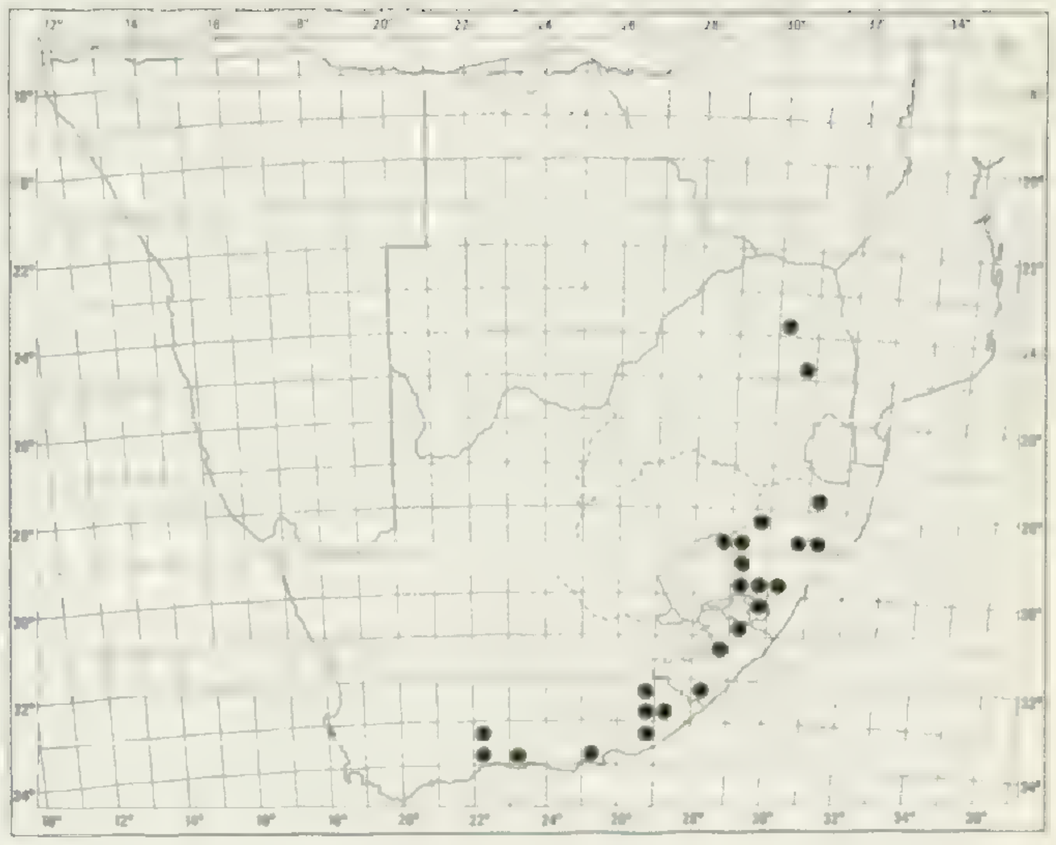
Vouchers: *Kemp* 1513; *Knox* 6; *Linder* 1229; *Oliver* 7153; *Russell* 2555; *Schelpe* 7937; *Smook* 1533; *Smook & Phelan* 664; *Van Rooy* 1573; *Von Breitenbach* 109.

Rhodobryum commersonii can be distinguished from other species of *Rhodobryum* by its obovate leaves, mostly plane leaf margins, subrectangular shape of the costa in cross section and the absence of a dorsal stereid band in the costa.

4. **Rhodobryum umbraculum** *(Hook.) Schimp.* ex *Par.*, Ind. Bryol. 1122 (1898); Broth. in Natürl. PflFam. 10: 404 (1924); Sim, Bryo. S. Afr. 339 (1926). Type: Cape, *Burchell-Hooker* 2507 (BM, lecto.), fide Ochi in J. Fac. Educ. Tottori Univ. 23: 115 (1972).



MAP 155.— ● **Rhodobryum commersonii**



MAP 156.— ● **Rhodobryum umbraculum**

Bryum umbraculum Bruch ex Hook., Musci Exot. 2: 133 (1819); Ochi in J. Fac. Educ. Tottori Univ. 23: 115 (1972).

Plants large to robust, solitary or gregarious, green or dark green above, reddish brown below; terricolous or humicolous. *Stems* erect from rhizomes, to 40 mm tall, simple or occasionally branching by subperichaetial innovations, red-brown, tomentose; rhizoids reddish brown, papillose. *Leaves* distant and reduced below, rosulate above, undulate, erect dry, widely spreading to squarrose wet; broadly obovate-spathulate, 7–15 mm long; apex generally obtuse, occasionally apiculate; margins plane above, recurved below, denticulate above; border (2–)3–4 cells wide, occasionally reddish. *Costa* ending below apex to apiculate, frequently reddish; in section subround to semicrescent shaped, ventrally slightly concave, laminal insertion ventral, ventral cells in 5–6 rows, dorsal substereid band weakly differentiated, dorsal cells incrassate, reddish, hydroids present between substereids and ventral cells. *Upper laminal cells* rhomboidal, (85–)100–150(–180) μm long, (35–)45–55 μm wide, pitted, gradually narrowed towards border; basal cells rectangular, pitted. Filamentous gemmae absent.

Dioicous, polysetaceous. Perichaetia terminal; leaves oblong-acuminate or triangular, reddish below; margins entire to denticulate; border weak or absent; costa ending below apex. *Seta* 27–32 mm long, reddish brown; capsule horizontal to pendulous, brown or reddish brown, straight or slightly curved, oblong-cylindrical, contracted below mouth dry, urn 3,0–3,5 mm long, neck 1,0–1,8 mm long, wrinkled dry; exothecial cells irregular in shape, incrassate, smaller at mouth, 1–2 rows at mouth in transverse rows; *peristome* teeth narrowly oblong-acuminate or lanceolate, yellowish brown, hyaline above, trabeculate, finely papillose, endostome segments keeled, broad below, tapered above, broadly perforated, cilia 3, appendiculate, basal membrane high, yellowish, minutely papillose; operculum conic; spores round, 15–17 μm, essentially smooth. Fig. 111: 1–10.

Rhodobryum umbraculum is known from eastern and southern Africa. In the Flora area this species is collected in forests of the southern and eastern Cape, Transkei, Natal, northeastern Orange Free State, Zululand and eastern and northern Transvaal. Map 156.

Vouchers: *Crosby & Crosby* 7905, 8094; *Jacot Guillarmod* PRE-CH13168; *Kemp* 849; *Magill* 5217, 6011; *Oliver* 6722; *Van Rooy* 76, 1251, 1420, 2232; *Von Breitenbach* 12.

Rhodobryum umbraculum is easily recognized by its darkish green, undulate, broadly obovate-spathulate leaves and costal anatomy.

MNIACEAE

Plants medium-sized to large, forming loose mats, dark green to yellow-green; terricolous or saxicolous. *Stems* erect, densely leaved above, tomentose below; central strand present; sometimes producing long-creeping, arching or prostrate, plagiotropic stolons, leaves distant. *Leaves* of stem crisped dry, spreading wet; oblong to elliptical or spathulate; stolon leaves shorter, rounded; margins generally bordered, frequently dentate, sometimes doubly dentate. *Costa* strong, guide cells present, with one or two stereid bands. *Laminal cells* generally isodiametric, smooth; marginal cells elongated.

Perichaetia terminal on erect stems, polysetaceous. *Seta* elongate; capsule erect to pendulous; peristome generally complete; operculum rostrate; calyptra small, cucullate, generally naked; spores medium-sized.

Only one of the ten genera recognized in Mniaceae is present in the Flora area. The family is primarily Northern Hemisphere in its distribution with its major species concentration in Asia.

PLAGIOMNIUM

Plagiomnium *Koponen* in Ann. Bot. Fenn. 5: 145 (1968); Smith, Moss Fl. Brit. Irel. 439 (1978). Type: *P. cuspidatum* (Hedw.) Kop.

Fertile stems erect, radiculose, producing plagiotropic stolons. *Leaves* large, margin with unistratose border, dentate, teeth single. *Costa* with dorsal stereid band only.

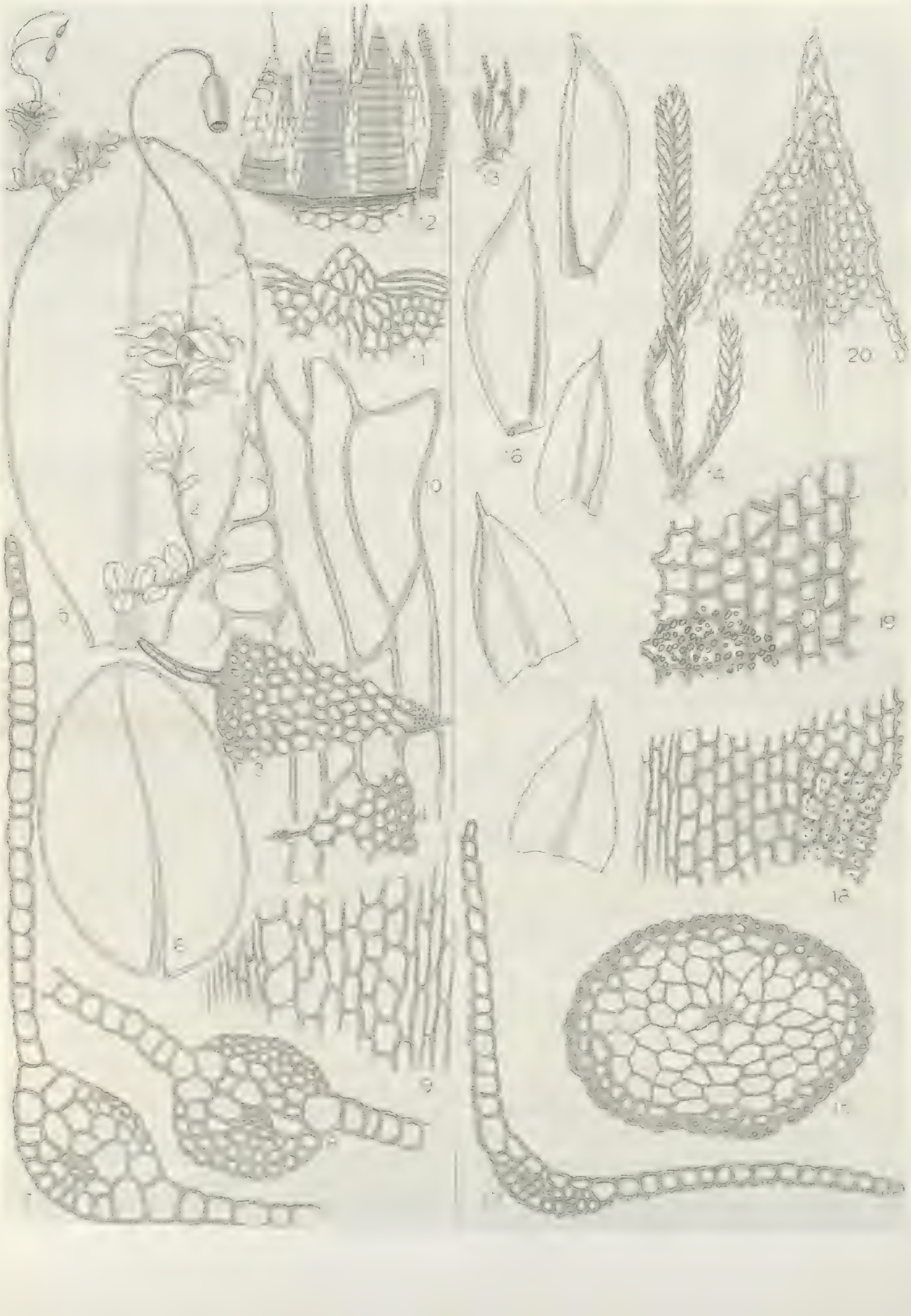
A widespread genus with approximately 25 species found on soil or rock in moist or shaded habitats.

Plagiomnium rhynchophorum *(Hook.) Kop.* var. **reidii** *(Dix.) Kop.* in Ann. Bot. Fenn. 18: 109 (1981). Type: Natal, Town Bush, Pietermaritzburg, *Reid* sub *Sim* 7552 (BM, holo.!; PRE!).

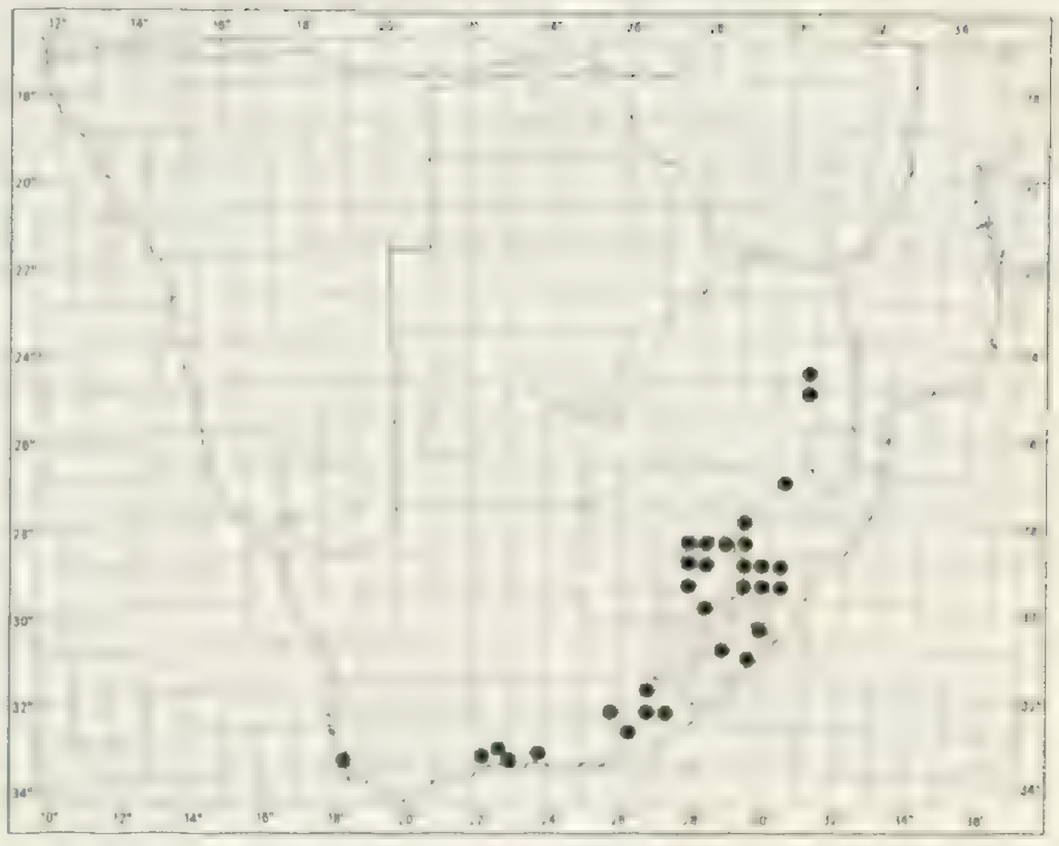
Mnium rostratum Schrad. var. *reidii* Dix. in Trans. Roy. Soc. S. Afr. 8: 204 (1920); Sim, Bryo. S. Afr. 342 (1926).

Mnium ecklonii C. Müll. in Bot. Ztg 13: 749 (1855); Broth. in Natürl. PflFam. 10: 415 (1924). Type: Cape, Winterberg, *Ecklon* s.n., 1825.

Plants medium-sized to large, in loose mats, dark green; terricolous or saxicolous. *Stems* erect, to 40 mm high, radiculose, densely leaved above; in section round, central strand large, cortical cells in 8–10 rows, large, thin-walled, becoming smaller and thickened toward margin. Plagiotropic stolons arising from various parts of erect stem, long creeping with leaves distant, anchored to substrate by rhizoid tufts; in section rounded, central strand small, inner cortical cells in 3–5 rows, large, thin-walled, outer cortical cells in 2 rows, smaller, thickened. *Stem leaves* larger and crowded toward apex, somewhat contorted dry, widespreading wet, undulate; oblong to oblong-spathulate or narrowly elliptical, 5–6 mm long; apex rounded to truncate or emarginate, mucronate; base narrow, slightly decurrent; margins plane, dentate to denticulate, occasionally entire. *Costa* strong below, tapering to apex, short excurrent as mucro; in proximal section elliptical, guide cells 4–6, large, thin-walled, ventral cells in 4 rows, first row above guide cells large, thin-walled, 3 outer rows smaller, incrassate, dorsal stereid band in small group of ± 12 cells in centre of costa, dorsal cells in 2–3 rows, larger, incrassate; in distal section rounded, guide cells large, distinct, dorsal stereid band absent, ventral and dorsal cells similar, each in 2 rows, thickened. *Stolon leaves* distant, somewhat scattered along stolon; orbicular to broadly elliptical, (1–)2–4 mm long; apex rounded-mucronate; margins plane, entire to serrate, strongly bordered; costa as in stem leaves. *Laminal cells* rounded, collenchymatous, quadrate to hexagonal or short-rectangular to short-rhomboidal, mostly 1–2:1, smooth, cell walls yellowish; extreme basal cells rectangular; marginal cells strongly differentiated, in 3–4 rows, elongate, ± vermiculate, thickened, yellowish; marginal teeth of 1–3 shorter cells.



Synoicous. Perichaetia terminal on erect stems, polysetaceous; leaves similar to upper stem leaves. *Seta* erect, 14–16(–20) mm long, yellowish above, reddish below, arcuate distally; capsule horizontal to pendulous, ovate to cylindrical-ovate, 3,5–4,5 mm long, yellowish; exothecial cells quadrate to subhexagonal, 2 rows at mouth transversely rectangular; stomata scattered on lower urn, cryptopore; *peristome* double, reddish yellow, exostome teeth 16, triangular, 0,5–0,6 mm long, strongly trabeculate, endostome yellowish, finely papillose, basal membrane to 0,15 mm high, segments alternating with teeth, weakly keeled, perforated above, cilia 3, as long as segments; operculum long rostrate; spores rounded, 25–27 μm, yellowish, essentially smooth. Fig. 113: 1–12.



MAP 157.— ● **Plagiomnium rhynchophorum** var. **reidii**

A member of the widespread *P. rostratum* complex, *P. rhynchophorum* is known from Asia, India and Africa. The variety *P. rhynchophorum* var. *reidii* is widespread in moist forests, woodlands and grasslands in the southern parts of the Cape Province, Transkei, Natal, eastern Orange Free State, Lesotho and the escarpment of the eastern Transvaal. Map 157.

Vouchers: *Crosby & Crosby* 7667; *Jacot Guillarmod* 6058; *Lambert* 4; *Magill* 4369, 5553; *Van Rooy* 476, 1444, 2826.

The dark green mats formed by plagiotropic stolons with distant, rounded leaves should quickly place most southern African specimens of *Plagiomnium*. Specimens with erect, fertile stems almost always have associated plagiotropic stolons. Dried fertile stems of *Plagiomnium* bear some resemblance to *Atrichum* P. Beauv., however in the Flora area specimens can easily be separated on leaf shape or presence of the ventral costal lamellae produced by *Atrichum*.

The southern African taxon has for some time been referred to *P. rostratum* (Hook.) Kop. (= *Mnium rostratum)* and a broader interpretation of that species (cf. Gangulee, 1974) would certainly include the southern African specimens. Koponen (1972) has indicated however, that the *P. rostratum* complex can be divided. It was therefore decided to treat the southern African specimens as a variety of *P. rhynchophorum* at this time.

FIG. 113.—**Plagiomnium rhynchophorum** var. **reidii** (1–12): **1.** habit, × 1; **2.** habit, × 2,5; **3.** portion of stem in cross section; ×170; **4.** portion of plagiotropic stolon in cross section, × 170; **5.** upper stem leaf, × 12; **6.** stolon leaf, × 12; **7.** proximal stem leaf in cross section, × 170; **8.** distal cross section of stem leaf costa, × 170; **9.** basal leaf cells (right side), × 175; **10.** cells at upper stem leaf margin, × 700; **11.** stem leaf apex, × 175; **12.** part of capsule mouth showing peristome, and side view of exostome tooth at right, × 70. **Eustichia longirostris** (13–20): **13.** habit, × 1; **14.** habit, × 5; **15.** stem cross section, × 175; **16.** leaves, × 70; **17.** leaf in cross section, × 175; **18.** basal leaf cells, papillae partly shown (right side), × 175; **19.** upper laminal cells at left margin, papillae partly shown, × 700; **20.** leaf apex, × 175. (1–12, *Rennie* 938; 13–20, *Cholnoky* 932).

EUSTICHIACEAE

Plants slender, forming dense tufts, light green; terricolous or saxicolous. *Stems* frequently elongate; central strand present. *Leaves* distichous, keeled, ovate-cuspidate; margins erose-denticulate. *Costa* short excurrent; in section cells weakly differentiated, mostly stereids. *Laminal cells* small, papillose.

Seta elongate; capsule suberect; exostome absent, endostome of 16 segments, weakly perforated, vertically striolate; operculum rostrate; calyptra cucullate.

The family consists of a single genus, *Eustichia*, that occurs at high altitudes in Central and South America and Africa.

EUSTICHIA

Eustichia *Mitt.* in J. Linn. Soc., Bot. 12: 603 (1869); Broth. in Natürl. PflFam. 10: 421 (1924); Sim, Bryo. S. Afr. 287 (1926); Bartram in Fieldiana 25: 185 (1949). Type species: *E. longirostris* (Brid.) Brid.

With characters of family.

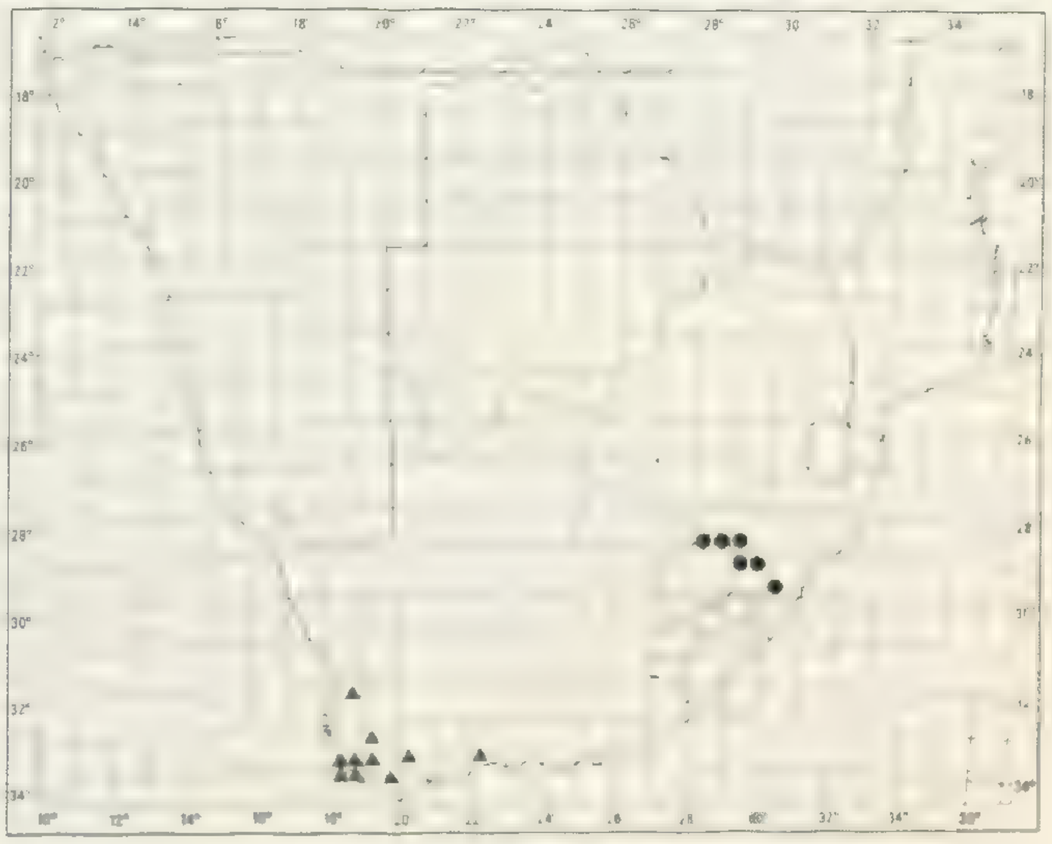
The genus contains 6 species; all except *E. longirostris*, the most widely distributed species, are restricted to the Americas. In southern Africa the genus is found at high altitude in the Drakensberg.

Eustichia longirostris *(Brid.) Brid.*, Bryol. Univ. 2: 789 (1827); Broth. in Natürl. PflFam. 10: 421 (1924); Sim, Bryo. S. Afr. 287 (1926). Type: Bourbon.

Pterigynandrum longirostrum Brid., Mant. Musc. 131 (1819). *Diplostichum longirostre* (Brid.) Mont. in Annls Sci. nat., bot. ser. 3, 4: 117 (1845).

Diplostichum africanum C. Müll. in Hedwigia 38: 53 (1899). *Eustichia africana* (C. Müll.) Par., Ind. Bryol. Supp. 152 (1900); Broth. in Natürl. PflFam. 10: 421 (1924); Sim, Bryo. S. Afr. 287 (1926). Type: Orange Free State, above Kadziberg, *Rehmann* 279 (PRE!).

Plants small but occasionally elongated, loosely caespitose, light green; terricolous. *Stems* up to 50 mm long, mostly buried, exposed chlorophyllose region 10–20 mm long, irregularly branched, radiculose below; in section subround, central strand present, inner cortical cells in 2–3 rows, large, thin-walled, outer cortical cells in 2 rows, stereids reddish yellow. *Leaves* complanate and distichous, conduplicate to carinate-concave, crowded to somewhat distant, appressed but little altered dry, erect wet; ovate-cuspidate; margins plane, erose-denticulate by projecting cell ends, frequently with adjoining cells projecting to form stronger tooth. *Costa* short excurrent, reflexed; in section cells not strongly differentiated, consisting of a single or double row of stereids with dorsal and ventral surface cells slightly larger and incrassate or more strongly thickened on outer wall. *Laminal cells* subquadrate to short-rectangular, thickened, mostly 1–2 : 1, papillose, cells with 3–4 low, blunt papillae over dorsal surface, ventral surface smooth; basal cells rectangular.



MAP 158.— ● **Eustichia longirostris**
▲ **Pyrrhobryum vallis-gratiae**

Sporophyte not known from southern Africa. Fig. 113: 13–20.

Collected at high altitudes in South America, southern Africa and the East African Islands. In the Flora area the species is known from subalpine grasslands of the Drakensberg of Lesotho, Natal and the Orange Free State. Map 158.

Vouchers: *Cholnoky* 932; *Esterhuysen* 26174; *Magill* 5513.

The slender, light green plants, with distichous, keeled leaves, form dense tufts on soil among rocks. The stems are frequently very long and the lower buried portions are yellowish brown and held together by interwoven rhizoids.

Eustichia africana, described from the Kadziberg in the northeastern Orange Free State is a depauperate form of this species.

RHIZOGONIACEAE

Plants small to large, forming loose tufts, yellowish green to dark green; growing on various substrates. *Stems* erect, simple or highly branched, occasionally with stipe-like lower portion and densely leaved upper portion, matted with dense tomentum at base or throughout lower stem; in section with central strand. *Leaves* distichous or spirally arranged, margins frequently thickened, often prominently toothed, sometimes doubly so, base occasionally decurrent. *Costa* strong, often spinose dorsally; in section with guide cells and dorsal and ventral stereid bands. *Laminal cells* isodiametric, incrassate.

Autoicous or dioicous. Perichaetia on short lateral branches at base of stem or above, leaves differentiated. *Seta* erect, generally very long; capsules erect to inclined, short-necked; peristome double, complete; operculum conic to conic-rostrate; calyptra cucullate; spores small.

A family of 9 genera confined mostly to the Southern Hemisphere. The family is recognized by its isodiametric laminal cells, generally differentiated and toothed leaf margins, strong costa, and basal or occasionally lateral perichaetia. The peristome is generally double and complete, however two genera, *Hymenodon* Hook. f. & Wils. and *Hymenodontopsis* Herz. lack exostome teeth. Only a single genus, *Pyrrhobryum,* is present in southern Africa.

PYRRHOBRYUM

Pyrrhobryum *Mitt.* in J. Linn. Soc., Bot. 10: 174 (1868), emend. Manuel, Cryptogamie 1: 68 (1980). Lectotype: *P. spiniforme* (Hedw.) Mitt., fide Manuel (1980).

Rhizogonium Brid. p.p., Bryol. Univ. 2: 644 (1827); Sim, Bryo. S. Afr. 342 (1926).

Manuel (1980) separated the genus *Pyrrhobryum* from *Rhizogonium* on the basis of spirally arranged leaves with multistratose borders, doubly toothed leaf margins, toothed dorsal costa and capsules with distinct necks. Both of the species in southern Africa belongs to the segregate genus of 28 species found primarily in the Southern Hemisphere. The widespread species *P. spiniforme* extends northward into southern North America and Asia.

1 Stems branching above; leaves appressed when dry, ovate-lanceolate, to 2 mm long..... 1. *P. vallis-gratiae*

1 Stems simple; leaves crisped when dry, linear-lanceolate, 4–8 mm long .....2. *P. spiniforme*

1. **Pyrrhobryum vallis-gratiae** *(Hampe) Manuel* in Cryptogamie 1: 70 (1980). Type: Cape, Gnadenthal, *Breutel* s.n. (BM, holo.!).

Mnium vallis-gratiae Hampe in Bot. Ztg 17: 205 (1859). *Rhizogonium vallis-gratiae* (Hampe) Hampe ex Jaeg. in Verh. St. Gall. naturw. Ges. 1873–74: 225 (1875); Broth. in Natürl. PflFam. 10: 428 (1924); Sim, Bryo. S. Afr. 344 (1926).

Plants small to medium-sized, caespitose, dark green or yellow-green with age; terricolous, saxicolous or corticolous. *Stems* 6–30 mm long, branching above short stipe, tomentose at base, stipe dark brown, naked or with small, distant, scale leaves; in section angular, central strand present, inner cortical cells in 3–4 rows, thickened, outer cortical cells stereids, in 2 rows, reddish. *Leaves* appressed dry, erect-spreading wet; ovate-lanceolate, 1,8–2,0 mm long; apex acuminate; margins plane, doubly toothed above mid-leaf, bistratose at base, multistratose above; in section forming small knob, 3–4 cells in diameter. *Costa* percurrent, ventral surface smooth, cells rounded-quadrate, dorsal surface sparsely spinose above mid-leaf, cells short-rectangular; in proximal section elliptical, guide cells 6–8, thickened, ventral stereid band 2 cells thick, dorsal stereid band 3 cells thick, ventral and dorsal surface cells similar, thickened; in distal section subtriangular, guide cells 4, thickened, ventral stereid band 1–2 cells thick, dorsal stereid band 2 cells thick, ventral and dorsal surface

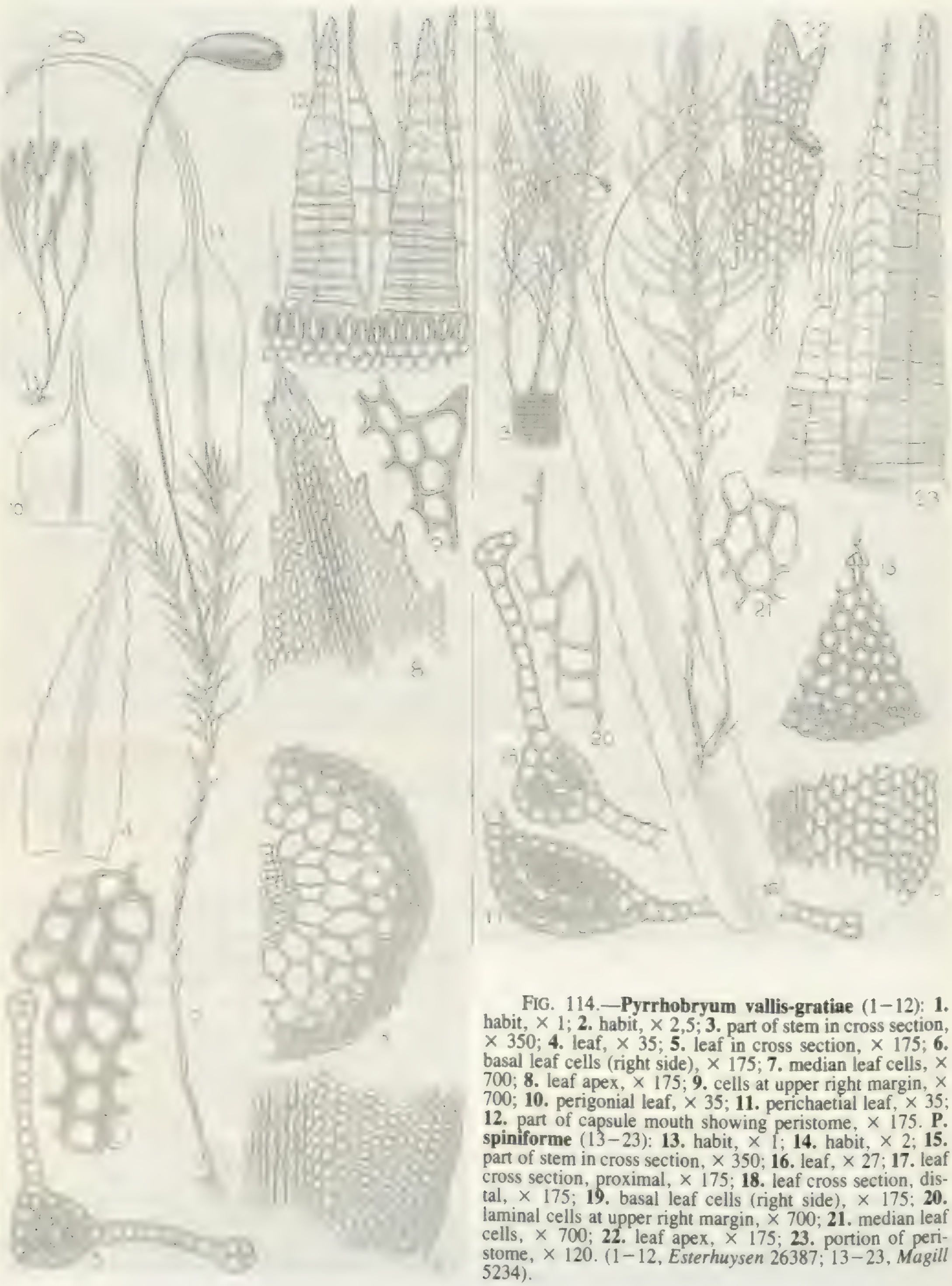


FIG. 114.—**Pyrrhobryum vallis-gratiae** (1–12): **1.** habit, × 1; **2.** habit, × 2,5; **3.** part of stem in cross section, × 350; **4.** leaf, × 35; **5.** leaf in cross section, × 175; **6.** basal leaf cells (right side), × 175; **7.** median leaf cells, × 700; **8.** leaf apex, × 175; **9.** cells at upper right margin, × 700; **10.** perigonial leaf, × 35; **11.** perichaetial leaf, × 35; **12.** part of capsule mouth showing peristome, × 175. **P. spiniforme** (13–23): **13.** habit, × 1; **14.** habit, × 2; **15.** part of stem in cross section, × 350; **16.** leaf, × 27; **17.** leaf cross section, proximal, × 175; **18.** leaf cross section, distal, × 175; **19.** basal leaf cells (right side), × 175; **20.** laminal cells at upper right margin, × 700; **21.** median leaf cells, × 700; **22.** leaf apex, × 175; **23.** portion of peristome, × 120. (1–12, *Esterhuysen* 26387; 13–23, *Magill* 5234).

cells similar, thickened. *Laminal cells* rounded, subquadrate, incrassate, somewhat irregular in size and shape, mostly 1:1, smooth; basal cells subquadrate, thickened.

Dioicous. Plants similar; perigonia gemmate, on short, lateral branches; leaves oval, abruptly subulate, 1 mm long, margins weakly toothed above. Perichaetia lateral on short branches; leaves oblong to elliptical, abruptly subulate, 2,5−3,0 mm long; margins with single teeth in subula; lower laminal cells rectangular, somewhat sinuolate, rounded and subquadrate above mid-leaf. *Seta* 15−20 mm long, yellowish; capsule inclined to horizontal, arcuate-clavate, 2 mm long, reddish yellow; exothecial cells subhexagonal, incrassate; stomata present at base of urn, phaneropore; annulus present; *peristome* double, exostome teeth triangular, 0,5 mm long, brownish yellow, with zig-zag median line, striate below, papillose above, endostome fragile, light yellow, weakly papillose, basal membrane high, segments as high as teeth, narrowly slit along keel, cilia shorter, 1−2; operculum conic with very short apiculus, cells not twisted; calyptra not seen; spores round, 20−25 μm, green, spiculate. Fig. 114: 1−12.

Endemic to southern Africa, *P. vallis-gratiae* is found in montane or kloof forests of the southwestern and southern Cape. Map 158.

Vouchers: *Brenan* M2750; *Crosby & Crosby* 8154; *Esterhuysen* 19182; *Magill & Schelpe* 4059, 4074.

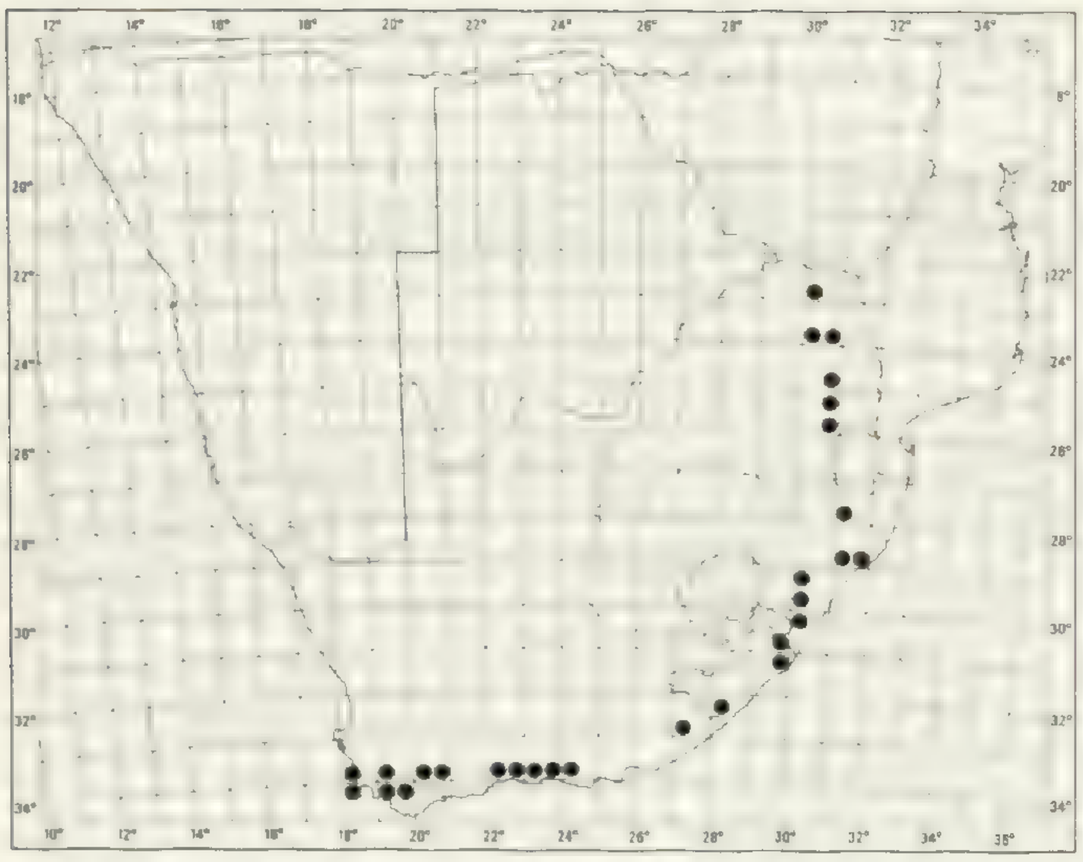
The species is recognized by its doubly toothed, multistratose leaf margins, spinose dorsal costal surface and isodiametric laminal cells. In comparison with *P. spiniforme*, the leaves of *P. vallis-gratiae* are much shorter and appressed when dry, giving the plants a julaceous appearance. In addition the perichaetia are borne on short lateral branches on the upper part of the stem, while in *P. spiniforme* the perichaetia are borne at the base of the stems.

2. **Pyrrhobryum spiniforme** *(Hedw.) Mitt.* in J. Linn. Soc., Bot. 10: 174 (1868); Manuel in Cryptogamie 1: 69 (1980). Type: Jamaica.

Hypnum spiniforme Hedw. Sp. Musc. 236 (1801). *Mnium spiniforme* (Hedw.) C. Müll., Syn. Musc. 1: 175 (1848). *Rhizogonium spiniforme* (Hedw.) Bruch ex Krauss in Flora 29: 134 (1846); Broth. in Natürl. PflFam. 10: 428 (1924); Sim, Bryo. S. Afr. 344 (1926); Andrews in Grout, Moss Fl. N. Amer. 2: 260 (1933); Gangulee, Moss. E. India 4: 1068 (1974).

Plants medium-sized, caespitose, dark green to yellow-green; terricolous, saxicolous or corticolous. *Stems* 10−50 mm long; generally simple, radiculose at base, lower stem forming a short, naked, dark brown stipe, when young with distant scale leaves; in section angular, central strand large, inner cortical cells in 6−8 rows, incrassate, outer cortical cells in 2−3 rows, strongly thickened, reddish. *Leaves* crisped dry, spreading wet; linear-lanceolate to lanceolate, (3−)5−8 mm long; apex acuminate; margins plane, doubly toothed by clear, sharp teeth above base, bistratose below, multistratose above, in section forming knob, 3−4 cells in diameter. *Costa* percurrent, ventral surface smooth, cells quadrate to short-rectangular, dorsal surface with distant spines, cells short-rectangular to quadrate; in proximal section elliptical, guide cells small, 6−8, incrassate, ventral stereid band strong, 3−4 cells thick, dorsal stereid band 2−3 cells thick, ventral and dorsal surface cells slightly larger, incrassate; in distal section subtriangular, guide cells 4−6, incrassate, ventral stereid band 2−3 cells thick, dorsal stereid band 2−3 cells thick, ventral and dorsal surface cells slightly larger, incrassate. *Laminal cells* somewhat variable in size and shape, rounded, quadrate to subhexagonal, mostly 1(−2):1, thickened, smooth; basal cells quadrate.

Synoicous. Paraphyses numerous, filiform. Perichaetia on short lateral branch at base of vegetative shoot; leaves obovate to elliptical, abruptly constricted to short subula, 1,5−2,0 mm long, margins serrate in subula, cells fusiform, mostly 10:1, incrassate. *Seta* erect to curved, 10−50 mm long, reddish yellow; capsule inclined to horizontal, clavate-arcuate, to 3 mm long, reddish yellow, gradually narrowing to a short neck, exothecial cells short-rectangular, somewhat shorter at mouth, reddish; stomata present on neck, phaneropore; annulus present; *peristome* double, yellowish, exostome teeth triangular, 0,6−0,7 mm long, with weak median zig-zag line, striate below, coarsely papillose above, endostome fragile, light yellow, weakly papillose, basal membrane high, segments as high as teeth, slit along keel, cilia shorter, 1 or 2; operculum obliquely rostrate, beak to 1,5 mm long; calyptra not seen; spores round, 20−25 μm, green, spiculate. Fig. 114: 13−23.



MAP 159.— ● **Pyrrhobryum spiniforme**

Although previously considered a widespread Southern Hemisphere species, recent authors (Scott & Stone, 1976; Sainsbury, 1955) have questioned its presence in Australia and New Zealand. In southern Africa the species is found in forests of the southwestern, southern and eastern Cape, Transkei, Natal, Zululand and the eastern and northern Transvaal. Map 159.

Vouchers: *Crosby & Crosby* 13395; *Magill* 5234, 6040; *Schelpe* 7862; *Van Rooy* 829; *Von Breitenbach* 79.

This species is easily recognized by its stem that consists of a lower, ± naked stipe-like portion with scattered scale leaves and an unbranched, densely leaved upper portion. The long, narrow, strongly toothed leaves are crisped when dry, thus separating it from the other southern African species. *Pyrrhobryum spiniforme* is closely related to the dioicous Australian species *P. paramattense* (C. Müll.) Manuel (cf. Scott & Stone, 1976, as *Rhizogonium).*

AULACOMNIACEAE

Plants medium-sized, in tufts, dark green to yellowish green, growing on a variety of substrates. *Stems* erect, branched, tomentose; central strand present. *Leaves* larger above, ovate-lanceolate, cuspidate; margins plane, irregularly toothed above. *Costa* short-excurrent; in section with guide cells and two stereid bands. *Laminal cells* small, irregularly isodiametric, incrassate, smooth.

Dioicous. Perichaetia terminal. *Seta* elongate; capsule erect, cylindrical, striate; peristome double, exostome teeth papillose with median zig-zag line, endostome complete, segments keeled, as long as teeth, cilia single, shorter than teeth; operculum conical; calyptra cucullate; spores small.

The family contains two genera, *Aulacomnium* and *Leptotheca*; only the latter is known from southern Africa. Two very widely distributed species of *Aulacomnium* are known from eastern Africa, *A. palustre* (Hedw.) Schwaegr. and *A. turgidum* (Wahlenb.) Schwaegr.; they may be separated from *Leptotheca* by their sharply papillose leaf cells and costa ending below the leaf apex.

LEPTOTHECA

Leptotheca *Schwaegr.*, Sp. Musc. Suppl. 2: 135 (1824); Broth. in Natürl. PflFam. 10: 440 (1924); Sim, Bryo. S. Afr. 299 (1926); Sainsb., N. Zeal. Mosses 287 (1955). Type species: *L. gaudichaudii* Schwaegr.

With characters of family.

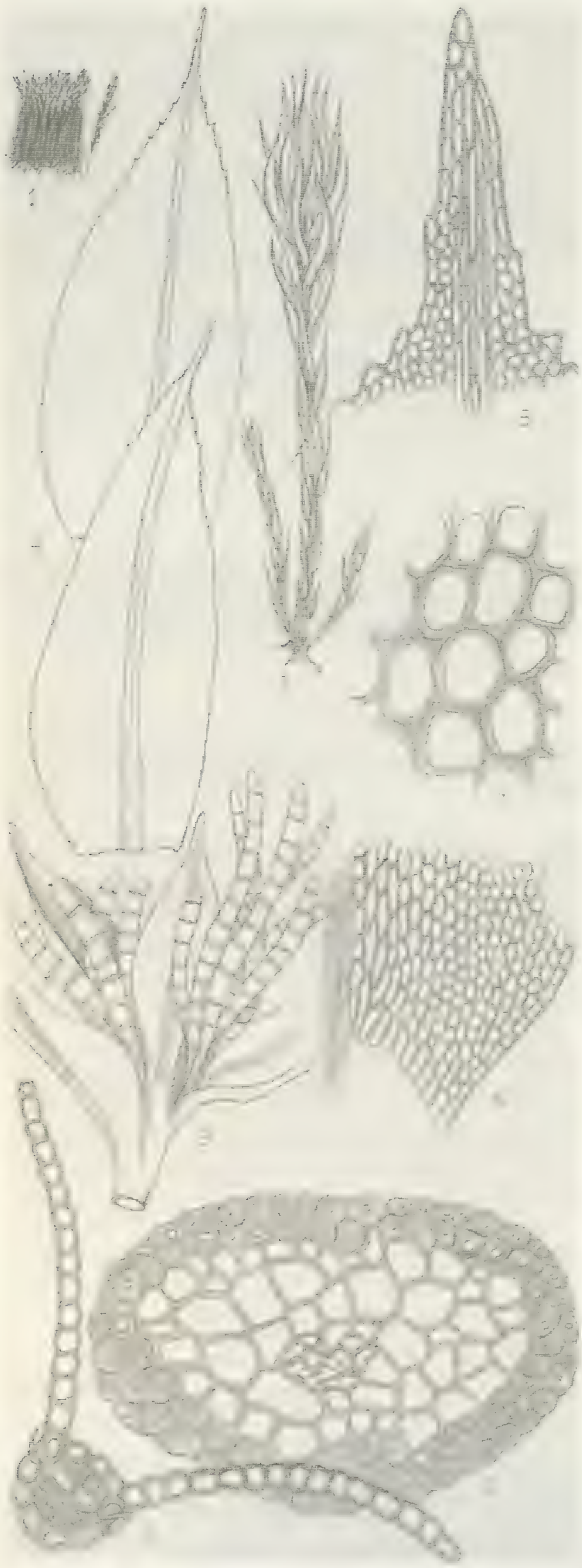
The genus contains 4 species, two endemic to the Americas, one Australian and *L. gaudichaudii* which is known from southern South America, southern Africa, Australia and New Zealand.

Leptotheca gaudichaudii *Schwaegr.*, Sp. Musc. Suppl. 2: 135 (1824); Broth. in Natürl. PflFam. 10: 440 (1924); Sim, Bryo. S. Afr. 300 (1926); Sainsb., N. Zeal. Mosses 287 (1955); Scott & Stone, Moss. S. Aust. 306 (1976). Type: Australia.

Aulacomnium gaudichaudii (Schwaegr.) Mitt. in Hooker's J. Bot. Kew Gdn Misc. 8: 262 (1856).

Plants medium-sized, caespitose, light green to dark green, glossy; terricolous, saxicolous or corticolous. *Stems* 10–30 mm long, irregularly branched, radiculose below; in section subround, central strand very small, inner cortical cells large, in 3–4 rows, weakly thickened, outer cortical cells stereids, in 2 rows, reddish. *Leaves* appressed and ± curved dry, erect-spreading wet; ovate-lanceolate, 2–4 mm long; apex acute, cuspidate; margins plane, serrate above mid-leaf. *Costa* short-excurrent; in section subround, guide cells 4–6, strongly thickened, ventral stereid band 1 cell thick, ventral surface cells substereids, dorsal stereid band 2 cells thick, dorsal surface cells substereids. *Laminal cells* variable in size and shape, rounded to subquadrate, incrassate, mostly 1: 1, smooth; basal cells slightly larger, rounded-rectangular, thickened. *Gemmae* infrequently produced, axillary in upper leaves and at apex, filamentous, 12–14 cells long, yellow-brown.

MAP 160.— ● **Leptotheca gaudichaudii**



Sporophyte not known from southern Africa. Fig. 115.

Leptotheca gaudichaudii is known from Patagonia, Terra del Fuego, Falkland Islands, southern Australia, Tasmania, New Zealand and southern Africa. In the Flora area the species is restricted to rock recesses and crevices in the mountain fynbos of the southwestern and southern Cape. Map 160.

Vouchers: *Brenan* M2770; *Esterhuysen* 20038; *Magill* 5933, 6338.

The glossy plants with ovate-lanceolate, cuspidate leaves and small, smooth and incrassate leaf cells will help to place specimens of *L. gaudichaudii*. Plants with gemmae are infrequently found in southern Africa, however when present the copious production of the long, brown, filamentous gemmae, in the axils of the upper leaves, is very obvious.

FIG. 115.—**Leptotheca gaudichaudii: 1.** habit, × 1; **2.** habit, × 10; **3.** stem in cross section, × 280; **4.** leaves, × 50; **5.** leaf in cross section, × 220; **6.** basal leaf cells (right side), × 175; **7.** median leaf cells, × 700; **8.** leaf apex, × 175; **9.** portion of stem showing axillary, filamentous gemmae, × 87. (1–9, *Esterhuysen* 30969a).

BARTRAMIACEAE

Plants small to large, occasionally robust, caespitose; terricolous or saxicolous. *Stem* erect, generally branching by subperichaetial innovation; central strand present, epidermis differentiated, cells large, thin-walled, fragile. *Leaves* lanceolate to ovate, occasionally broader, lamina infrequently bistratose; apex acuminate to subulate, or infrequently acute to obtuse or rounded; base scarcely differentiated or strongly differentiated with lamina reflexed above; margins plane to recurved, entire to crenulate or serrate, frequently doubly so. *Costa* percurrent to short-excurrent, rarely ending just below apex. *Laminal cells* rectangular to linear, generally incrassate, papillose or prorate, papillae centered over lumen or displaced toward end of cell; basal cells rectangular or quadrate, thin-walled, generally smooth.

Autoicous or dioicous. Perichaetia terminal, frequently overgrown by subperichaetial branches. *Seta* elongate, erect; capsule erect to inclined or horizontal, urn globose, smooth or rarely with wart-like projections, rugulose to furrowed or sulcate dry; peristome absent or present, single or double, endostome with segments and cilia or frequently rudimentary; operculum convex to conic or rostrate; calyptra cucullate, quickly lost; spores reniform or rounded, papillose or warty.

Eight of the ten genera of Bartramiaceae are known from southern Africa. Members of the family are recognized by the generally dull appearance of the appressed or wide-spreading leaves, and common occurrence of reddish tomentum on the stem; rectangular, generally incrassate leaf cells with papillae mostly displaced toward cell ends, and especially by their globose or rounded, frequently inclined capsules.

1 Stem in cross-section triangular; leaf cells minutely verruculose-striolate ..... 1. **Plagiopus**

1 Stems rounded to angular in cross-section, not triangular; leaf cells smooth, papillose or prorate:
  2 Vegetative leaves less than 2,5 mm long:
    3 Costa absent or rudimentary ..... 5. **Quathlamba**
    3 Costa well developed, extending above apex:
      4 Leaves appressed in 5 distinct rows, ± triangular; costa abruptly excurrent as short awn; peristome single, teeth joined above ..... 4. **Conostomum**
      4 Leaves variously erect to spreading, not in distinct rows; costa occasionally excurrent, never abruptly so; peristome absent or double, teeth not joined above:
        5 Leaves mostly 1,5–2,5 mm long; stems with few subperichaetial innovations; capsule sulcate dry, mouth broad, peristome absent ..... 3. **Bartramia**
        5 Leaves mostly less than 1,5 mm long; stems with numerous subperichaetial innovations:
          6 Capsules erect, globose or warty, little altered dry, gymnostomous, mouth small ..... 6. **Bartramidula**
          6 Capsules inclined or horizontal, globose to ellipsoidal, striate to sulcate dry, mouth wide, peristome present ..... 7. **Philonotis**
  2 Vegetative leaves (2,5–) 3,0–6,0 mm long:
    7 Leaves with distinct border of narrow, elongated cells ..... 7. **Philonotis**
    7 Leaves without distinct border:
      8 Plants generally large, occasionally robust; leaves plicate in base or plications extending to upper leaf ..... 8. **Breutelia**
      8 Plants smaller; leaves without well defined plications:
        9 Upper lamina bistratose:

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10 Leaf base differentiated, hyaline and sheathing; plants dull, glaucous; leaf margin serrate by projecting cell ends ..... 3. **Bartramia**

10 Leaf base not differentiated; plants green; leaf margins denticulate, teeth formed by differentiated marginal cells ..... 2. **Anacolia**

9 Upper lamina unistratose:

11 Leaves ovate- to oval-acuminate, some weakly plicate; peristome present, double ..... 8. **Breutelia**

11 Leaves linear-lanceolate to ovate- or oblong-lanceolate, lamina not plicate; peristome absent ..... 3. **Bartramia**

1. PLAGIOPUS

Plagiopus *Brid.*, Bryol. Univ. 1: 596 (1826); Broth. in Natürl. PflFam. 10: 448 (1924); Flowers in Grout, Moss Fl. N. Amer. 2: 157 (1935); Gangulee, Moss. E. India 4: 1080 (1974); Smith, Moss Fl. Brit. Irel. 454 (1978). Type species: *P. serratus* Brid.

Plants medium-sized, caespitose; saxicolous. *Stems* erect, irregularly branched, tomentose below; in section triangular, central strand present, epidermal cells distinct. *Leaves* narrowly lanceolate; margins recurved, doubly serrate above. *Costa* percurrent. *Laminal cells* rectangular, papillose with numerous low, short ridges; basal cells slightly differentiated.

Synoicous. *Seta* elongate; capsule globose, weakly striate dry; peristome double; operculum plano-convex; calyptra cucullate; spores warty.

Plagiopus contains two species, *P. crassinervius* (Mitt.) Broth. which is endemic to New Zealand and *P. oederi* (Brid.) Limpr. which is widespread in Asia, Europe and some parts of North and South America. This is the first report of *Plagiopus* from Africa. The genus is restricted to the Afro-alpine regions of the Drakensberg and the high grass-heathlands of Lesotho.

The genus resembles *Bartramia* but is separated from it, and the other genera of Bartramiaceae, by the triangular shape of the stem in cross-section and the unusual leaf cell ornamentation.

Plagiopus oederi *(Brid.) Limpr.*, Laubm. Deutschl. 2: 548 (1895); Broth. in Natürl. PflFam. 10: 449 (1924); Flowers in Grout, Moss Fl. N. Amer. 2: 157 (1935); Gangulee, Moss. E. India 4: 1081 (1974); Smith, Moss Fl. Brit. Irel. 454 (1978). Type: Europe.

Bartramia oederi Brid., Musc. Rec. 2: 135 (1803).

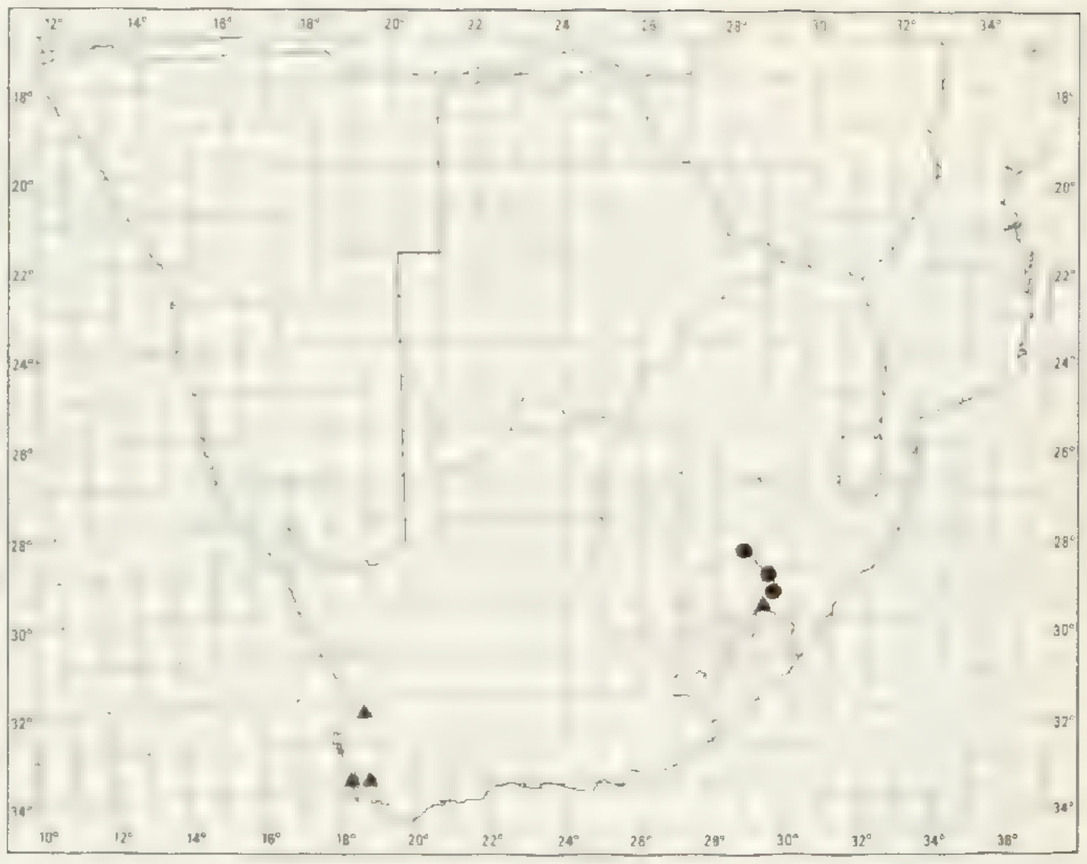
Plants medium-sized, caespitose, light green to yellow-green above, reddish brown below; saxicolous. *Stems* erect, 20–30 mm tall, irregularly branched above, lower stems covered with reddish tomentum, radicles papillose with numerous large, high papillae; in section distinctly three-sided, subtriangular, central strand very small, inner cortical cells in 6–8 rows, large, thin-walled, reddish, outer cortical cells in 2 rows, stereids, reddish yellow, epidermal cells differentiated, thin-walled, fragile, quickly eroded. *Leaves* erect and weakly flexuose dry, erect-spreading wet; narrowly lanceolate, 2–4 mm long; apex acuminate; margins recurved from base to upper leaf, entire below, sharply serrate above, frequently doubly serrate. *Costa* percurrent, superficial cells long-rectangular, papillose; in section bulging dor-

FIG. 116.—**Plagiopus oederi** (1–13): **1.** habit, × 1; **2.** habit, × 3; **3.** stem in cross section, × 87; **4.** leaves, × 35; **5.** leaf in cross section, × 350; **6.** basal leaf cells (left side), × 175; **7.** upper laminal cells, × 700; **8.** marginal leaf cells (right side), × 700; **9.** leaf apex, × 175; **10.** capsule, wet, × 6; **11.** capsule, dry, × 6; **12.** part of capsule mouth showing cells and peristome, × 140; **13.** spore, × 700. **Anacolia breutelii** (14–27): **14.** habit, dry (upper plant var. **squarrifolia**, lower plant var. **breutelii**), × 1; **15.** habit, dry (var. **squarrifolia**), × 2; **16.** part of stem in cross section, × 175; **17.** lower leaf, × 35; **18.** upper leaf, × 35; **19.** leaf in proximal cross section, × 350; **20.** leaf in distal cross section, × 350; **21.** basal leaf cells (left side), × 175; **22.** marginal leaf cells (right side), × 700; **23.** leaf apex, × 175; **24.** capsule, dry, × 6; **25.** capsule, wet, × 6; **26.** part of capsule mouth showing cells and peristome, × 140; **27.** exothecial cells, × 700. [1–13, *Van Zinderen Bakker* 446; 14 (upper plant) & 15, *Pillans* 10032; 14 (lower plant) & 16–27, *Breutel* s.n.].

sally, subround, guide cells 2–4, large, thickened, ventral cells in single layer, smaller than guide cells, thickened, dorsal substereid band 3–4 cells thick, dorsal surface cells not differentiated. *Upper laminal cells* rectangular, 4–6: 1, thickened, minutely verruculose-striolate, as numerous low, short ridges, occasionally a few cells also prorate distally; basal cells slightly longer rectangular, minutely verruculose-striolate; alar cells not differentiated.

Perichaetia terminal, leaves similar to vegetative leaves; basal leaf cells long-rectangular to linear, smooth, yellowish. *Seta* 8–12 mm long, reddish yellow; capsule weakly inclined, urn globose, 2,0–2,5 mm long, weakly striate dry, reddish yellow, mouth frequently oblique; exothecial cells large, hexagonal to rectangular or quadrate, thin-walled; stomata present at base of urn, phaneropore to subphaneropore; *peristome* double, exostome teeth 16, narrowly triangular, 0,3 mm high, papillose, with median zig-zag line, trabeculae strong, endostome segments 16, fragile above, finely papillose; operculum plano-convex; calyptra cucullate; spores subround to ovoid, 15–27 μm, warty, yellow-brown. Fig. 116: 1–13.

New to Africa, the species has recently been collected on rock in the subalpine grasslands of Natal and northern



MAP 161.— ● **Plagiopus oederi**
▲ **Anacolia breutelii** var. **squarrifolia**

and eastern Lesotho. *Plagiopus oederi* is also known from Europe, Asia, North America and Oceania. Map 161.

Vouchers: *Esterhuysen* 26178, 35929; *Meyer* 1040D; *Van Rooy* 1302, 1340; *Van Zinderen Bakker* 446.

In addition to the stem being ± triangular in cross-section, the very distinctive leaf cell ornamentation will identify this species. The cell surfaces are covered by numerous low ridges that give an impression of small papillae that were stretched by elongation of the cells. In cross-section the cells appear to be covered with numerous low, blunt papillae.

2. ANACOLIA

Anacolia *Schimp.*, Syn. Musc. europ. edn 2: 513 (1876), nom. cons.; Broth. in Natürl. PflFam. 10: 449 (1924); Flowers in Grout, Moss Fl. N. Amer. 2: 154 (1935); Flowers in Bull. Torrey bot. Club 79: 161 (1952); Gangulee, Moss. E. India 4: 1083 (1974). Lectotype species: *A. webbii* (Mont.) Schimp., fide Flowers in Bull. Torrey bot. Club 79: 161 (1952).

Plants medium-sized, caespitose; terricolous or saxicolous. *Stems* erect, sparsely branched, tomentose below; central strand present, epidermis not differentiated. *Leaves* linear-lanceolate, lamina bistratose above; base not strongly differentiated; margins denticulate. *Costa* short-excurrent. *Laminal cells* short-rectangular, prorate; basal cells long-rectangular, weakly differentiated.

Dioicous. Perichaetia becoming lateral through innovation. *Seta* elongate; capsule inclined, subglobose wet, rugulose dry; peristome double, endostome rudimentary; operculum convex; calyptra cucullate; spores warty.

The nine species of *Anacolia* are found primarily in the Americas and Africa, although they are also known from Europe and parts of Asia.

In southern Africa, the genus is recognized by having stems without a differentiated epidermis, coarsely serrate or denticulate leaf margins, bistratose laminas and undifferentiated leaf bases. In addition the capsules are rugulose or wrinkled when dry and the southern African species has a double peristome. *Anacolia breutelii* could be mistaken for a *Bartramia* but in addition to the characters listed above, it is a slightly larger plant with a coarser look and texture.

Anacolia breutelii *(C. Müll.) Magill*, comb. nov. Type: Cape, Soutkloof, *Breutel* s.n. (BM!; G!).

Bartramia breutelii C. Müll. in Bot. Ztg 16: 162 (1858). *Breutelia breutelii* (C. Müll.) Broth. in Natürl. PflFam. 10: 470 (1924).

Bartramia afrostricta C. Müll. in Hedwigia 38: 94 (1899). Syntypes: Cape, Cape Town, *Rehmann* 203 & 204 (PRE!).

Plants medium-sized, loosely caespitose, green to yellow-green or reddish above, brownish to blackish brown below; terricolous or saxicolous. *Stems* erect, 10−30 mm tall, sparsely branched, reddish tomentum on lower stem; in section round, central strand present, inner cortical cells in 6−8 rows, thin-walled, yellowish, outer cortical cells in 2 rows, cells small, stereids or substereids, reddish to dark red, epidermal cells not differentiated. *Leaves* closely set, generally appressed but infrequently squarrose-recurved dry, erect-spreading to squarrose wet; linear-lanceolate, (2,0−)2,5−3,5(−4,5) mm long, ventral surface flat over costa, lamina bistratose juxtacostally and in irregular patches just above base, completely bistratose in upper leaf; apex subulate; margins reflexed to recurved, doubly denticulate in subula by large, smooth, clear cells, distinct from laminal cells. *Costa* short-excurrent as denticulate awn, occasionally reddish below, ventral superficial cells rectangular, prorate to sharply dentate in upper subula; in section bulging dorsally, subtriangular, guide cells 6, small but distinct, ventral stereid to substereid band 1−3 cells thick, ventral surface cells smaller than guide cells, incrassate, prorate, dorsal stereid to substereid band strong, 3−4 cells thick, dorsal surface cells incrassate, prorate. *Laminal cells* rectangular, 1,5−3,0: 1, weakly thickened, strongly or weakly prorate distally and/or proximally; basal cells long-rectangular, to 10: 1, thin-walled, smooth, yellowish; alar cells weakly differentiated, quadrate, clear.

Perigonia terminal, gemmate. Perichaetia terminal, becoming lateral through innovation; leaves similar to vegetative leaves, elliptical-subulate. Sporophytes rare. *Seta* 7 mm long, yellowish; capsule inclined, urn subglobose, 2 mm long, rugulose dry, red-brown; exothecial cells subhexagonal, thickened in corners; stomata present at base of urn, phaneropore; *peristome* double, exostome teeth 16, narrowly triangular, 0,3 mm long, papillose, reddish yellow, endostome rudimentary, irregular and very short, attached to teeth, smooth; operculum not seen; young calyptra cucullate, smooth; spores rounded, 12–18 μm, warty, yellowish. Fig. 116: 14–27.

Considerable confusion has arisen around the use of the name *Bartramia substricta* sensu Sim (1926) and Dixon (1920). A careful examination of type specimens at BM and G has confirmed Müller's descriptions and label data for *Bartramia breutelii* C. Müll. and *B. substricta* Schimp. ex C. Müll.

The problem seems to have been created through mistakes in interpretation and observation. The specimens of *A. breutelii* are macroscopically similar to the European species *Bartramia stricta* Brid. These southern African specimens were coupled through this superficial similarity to Müller's name *B. substricta* by Dixon and Sim, and the name *B. breutelii* was apparently overlooked. The statement by Dixon (1920), "*B. afrostricta* C. M. is entirely identical with *B. substricta* Schimp. ex C. Müll., as a comparison of Rehm. M. Austr.-Afr. 203, 204, 205, with Schimper's type as Kew shows", further complicated the problem since the syntypes of the former are *Anacolia* and the type of the latter is a *Breutelia*. Since my observations are compatible with Müller's descriptions, it seems unlikely that Dixon made more than a casual examination of the specimens involved.

In the generic configuration used here *Bartramia breutelii* is treated under *Anacolia*, while *B. substricta* is transferred to *Breutelia*. As a result of incorrect use of the name *Bartramia substricta* by Sim and Dixon, all of the specimens of *Anacolia breutelii* that were examined had been placed under *Bartramia substricta;* while specimens of *Breutelia substricta* had been placed under a later name, i.e. *Breutelia afroscoparia*.

Presently known only from southern Africa, the species is infrequently collected on rock or soil over rock at higher elevations in the mountains of the southwestern and northwestern Cape and the Drakensberg of Natal, Lesotho and Orange Free State. Two varieties are recognized; their distributions are practically sympatric.

1 Leaves erect to appressed dry ..... var. *breutelii*
1 Leaves squarrose-recurved dry ..... var. *squarrifolia*

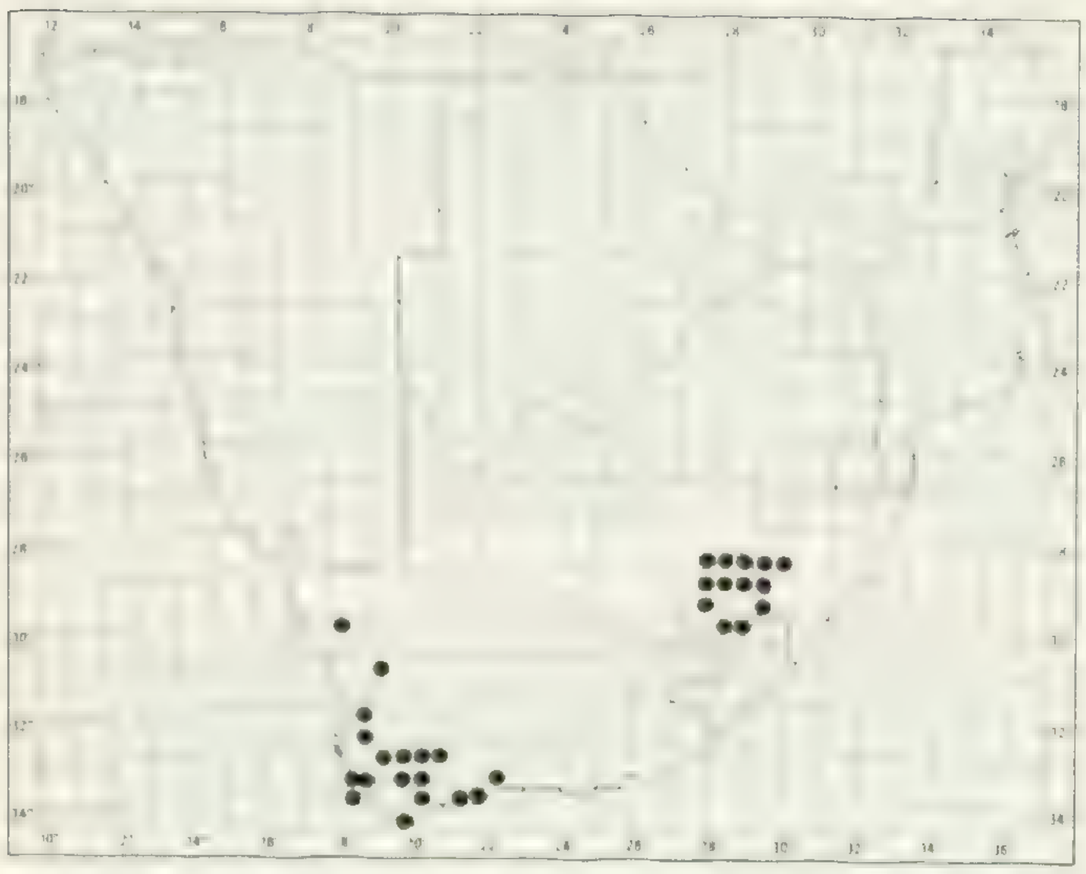
var. **breutelii.**

Leaves erect to appressed dry, erect-spreading wet; mostly 2−4 mm long.

Endemic to southern Africa, the typical variety is frequently collected in the mountains of Lesotho, eastern Orange Free State, Natal and the southern, southwestern and northwestern Cape. Map 162.

Vouchers: *Esterhuysen* 20204; *Magill* 4396, 4713, 6092; *Oliver* 7237; *Van Rooy* 389.

The taxon is vegetatively similar to *A. abyssinica* (C. Müll.) Flow., but sporophytically it is more closely related to *A. menziesii* (Turn.) Par. The presence of a peristome excludes this taxon from *A. abyssinica*.



MAP 162.— ● **Anacolia breutelii** var. **breutelii**

var. **squarrifolia** *(Sim) Magill*, stat. nov. Lectotype: Cape, Lion's Rump, *Pillans* 4089 (PRE, lecto. selected here!; BM!; BOL!).

Bartramia squarrifolia Sim, Bryo. S. Afr. 302 (1926).

Leaves squarrose-recurved dry, wide-spreading to squarrose wet; mostly 3–5 mm long.

Endemic to southern Africa, this variety is rarely collected in the Drakensberg of western Natal and a few sites in the mountains of the southwestern Cape. Map 161.

Vouchers: *Hilliard & Burtt* 10115; *Magill & Schelpe* 3849; *Pillans* 10032.

Similar to the typical variety in all respects except for the squarrose spreading leaves that give the plants a very distinctive appearance. Macroscopically the plants resemble *Bartramia capensis* but are easily separated from that species by differences in leaf cells, serration of the leaf margins and bistratose lamina.

3. BARTRAMIA

Bartramia *Hedw.*, Sp. Musc. 164 (1801), nom. cons.; Broth. in Natürl. PflFam. 10: 451 (1924); Sim, Bryo. S. Afr. 300 (1926); Flowers in Grout, Moss Fl. N. Amer. 2: 157 (1935); Sainsb., N. Zeal. Mosses 300 (1955); Gangulee, Moss. E. India 4: 1086 (1974); Scott & Stone, Moss. S. Austr. 322 (1976); Smith, Moss Fl. Brit. Irel. 454 (1978); Catcheside, Moss. South Austr. 279 (1980). Lectotype species: *B. halleriana* Hedw., fide Flowers in Grout, Moss Fl. N. Amer. 2: 158 (1935).

Plants small to medium-sized, caespitose; terricolous or saxicolous. *Stems* erect, branches few, generally subperichaetial innovations, sparsely tomentose below; in section round, central strand present, epidermal cells ± distinct. *Leaves* linear to lanceolate or subulate above broad, sheathing base; lamina unistratose or bistratose; margins mostly serrate. *Costa* short- to long-excurrent. *Laminal cells* rectangular to long-rectangular, ± incrassate, prorate or papillose; basal cells scarcely differentiated or very strongly differentiated.

Dioicous, autoicous or synoicous. Perichaetia becoming lateral through innovation. *Seta* short or long; capsules ± inclined, globose to ovoid wet, sulcate dry; peristome absent; operculum conic or convex-apiculate; calyptra cucullate, small; spores warty.

The genus contains approximately 90 species and is found on every continent, including Antarctica. Major centres of described species are in Central America and western South America.

Bartramia is separated from the other southern African genera of the family by its long, slender leaves and absence of a peristome although peristomes are generally present in the genus. It is unlikely to be confused with any other genus except *Anacolia*; see note there.

1 Leaves with well defined, hyaline, sheathing base; lamina bistratose above base ..... 4. *B. hampeana*
1 Leaves without strongly differentiated base; lamina unistratose:
2 Leaves ovate-acuminate; laminal cells short-rectangular, incrassate, ± flexuose; leaf base to 20 cells wide on each side of costa ..... 3. *B. aristaria*

2 Leaves linear-lanceolate; laminal cells short- to long-rectangular, not flexuose; leaf base less than 15 cells wide on each side of costa:

3 Upper laminal cells short-rectangular, ± smooth to weakly prorate; costa percurrent to short-excurrent; spores 25–32 μm in diameter ..... 1. *B. compacta*

3 Upper laminal cells long-rectangular throughout, with single high papilla over lumen or displaced towards proximal end of cell; costa short- to long-excurrent; spores to 50 μm in diameter ..... 2. *B. capensis*

1. **Bartramia compacta** *Hornsch.*, Hort. Phys. Berol. 63 (1820); Broth. in Natürl. PflFam. 10: 457 (1924); Sim, Bryo. S. Afr. 303 (1926). Type: Cape, Lion's Mountain, *Bergius* s.n. (BM!).

Bartramia kraussii B.S.G., Bryol. Eur. 4: 40 (1842). Type: Cape, Cape Town, *Krauss* s.n. (BM!; MANCH!).

?*Bartramia subasperrima* C. Müll. in Hedwigia 38: 95 (1899); Broth. in Natürl. PflFam. 10: 457 (1924). Type: Cape, Cape Town, *Rehmann* 213; vide note below.

Plants small, caespitose, yellow-green to light green or glaucous green; terricolous. *Stems* 3–10 (–15) mm high, radiculose below; in section round, central strand large, inner cortical cells in 3–4 rows, large, thin-walled, outer cortical cells in 1–2 rows, smaller, weakly thickened, yellow-brown, epidermis not differentiated or outer walls not as strongly thickened. *Leaves* erect dry, erect-spreading to widespreading wet; linear-lanceolate, (2,0–) 2,5–3,0 mm long, lamina unistratose; apex acuminate; margins reflexed, doubly serrate above base. *Costa* percurrent to short-excurrent, superficial cells rectangular, smooth to prorate ventrally, dentate above dorsally; in section subround to triangular, bulging dorsally, guide cells 4, larger than other cells, incrassate, ventral cells in 1–3 rows, smaller than guide cells, incrassate, dorsal stereid band 3–5 rows thick, dorsal surface cells not differentiated or substereids. *Upper laminal cells* rectangular, mostly 4–6 (–8): 1, weakly thickened, weakly prorate; basal cells rectangular, 10: 1, thin-walled; alar cells quadrate, not forming distinct group.

Synoicous. Perichaetia lateral through innovation, leaves not differentiated. *Seta* 7–10 mm long or infrequently short, 2 mm long, reddish yellow; capsule ± erect, urn globose and smooth wet, broadly short-cylindrical and sulcate dry, 1,0–1,2 mm long, yellowish with dark red mouth; exothecial cells subhexagonal, weakly thickened or thin-walled with slightly thickened corners, 2–4 rows of cells at mouth smaller, quadrate to transversely rectangular; stomata present at base of urn, phaneropore; *peristome* absent, occasionally with fragile, hyaline fringe at mouth; operculum convex-apiculate, more strongly apiculate dry; calyptra not seen; spores subround, 25–32 μm, warty, yellowish brown. Fig. 117: 1–12.

Dixon & Gepp (1923) suggested that Müller (1899) was in error citing *Rehmann* 213 as the type for *B. subasperrima* as it would be out of place in Rehmann's exsiccate. However, it appears that Müller was not citing a specimen from the exsiccate (Coll. Musc. austro-africani No. *or* Coll. Musc. A. A. No.) but rather a number from a packet sent to Müller by Rehmann prior to the distribution of the exsiccate (Coll. No. 213). Dixon & Gepp's reference to Rehmann's exsiccate No. 191 is also a mistake since in their list and on the specimen, the number for *B. subasperrima* is 199. Most of the evidence at this time indicates that the Rehmann exsiccate specimens may represent isotype material; see also Codd & Gunn (1982).

Endemic to southern Africa, the species is collected on soil in mountains of the Cape Province. Two varieties are recognized:

1 Seta very short, to 2 mm long; capsules immersed to emergent ..... var. *macowaniana*

1 Seta longer, 7–10 mm long; capsules exserted ..... var. *compacta*

var. **compacta.**

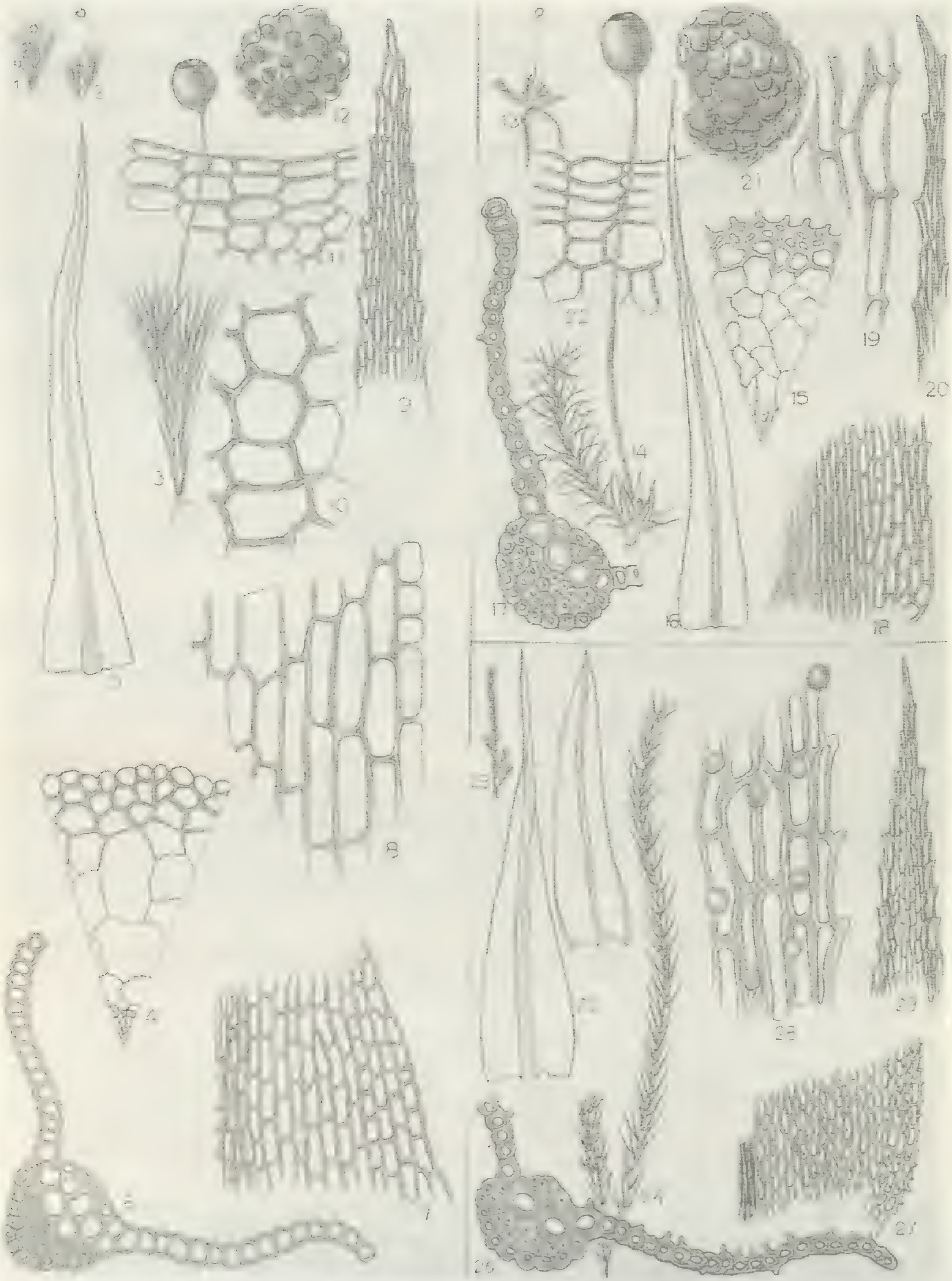
Stems mostly 5–10 mm high. *Seta* 7–10 mm long, exserting capsule above plants.

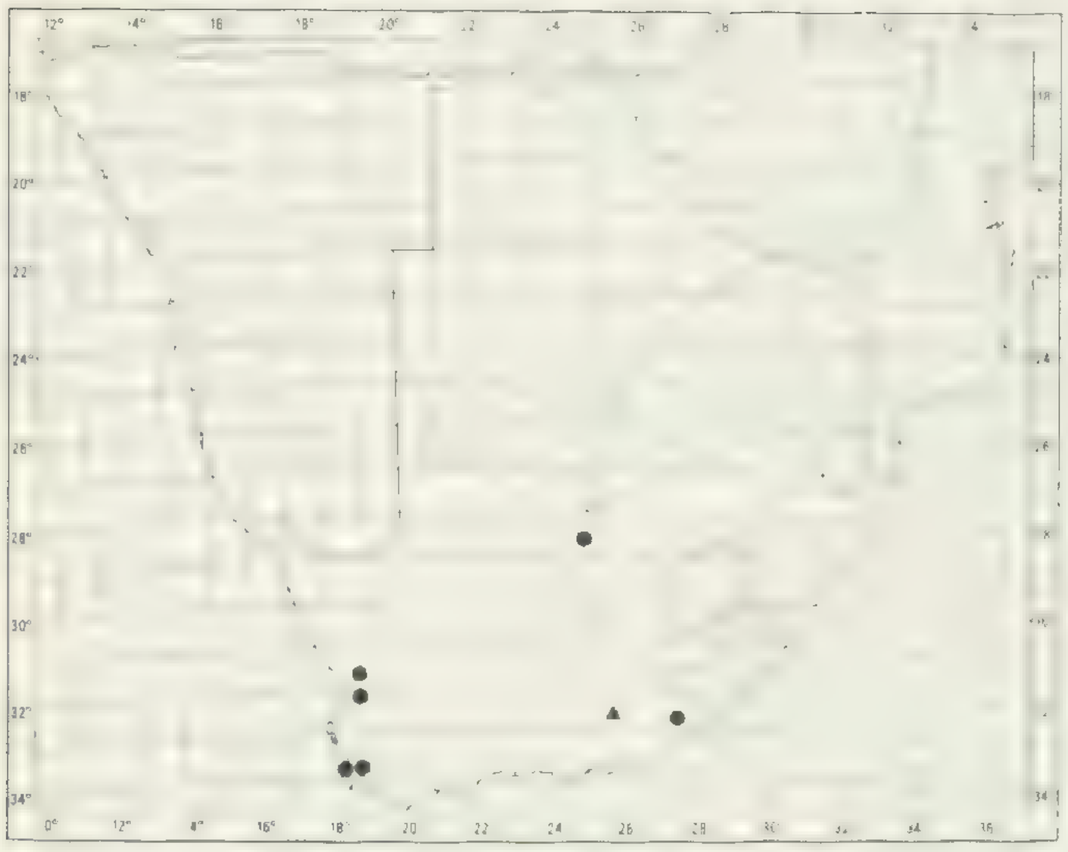
This variety is infrequently collected in the mountains of the southwestern, northwestern and eastern Cape. A single specimen is also known from the northern Cape. Map 163.

Vouchers: *Garside* 6546, 6680; *Magill & Schelpe* 4016.

The short, rigidly erect, unistratose leaves, without strongly differentiated bases, and the gymnostomous capsules that are strongly sulcate when dry will separate specimens of *B. compacta* from most members of the family. The typical variety is separated from *B. compacta* var. *macowaniana* primarily by its longer seta, and from *B. capensis* by its narrower, more consistently erect leaves, smooth to only weakly prorate leaf cells and much smaller spores; see note under that species.

var. **macowaniana** *(C. Müll.) Magill*, stat. nov. Type: Cape, Somerset East, Boschberg, *MacOwan* s.n., 1877 (NBG!; NH!).





MAP 163.— ● **Bartramia compacta** var. **compacta**
▲ **Bartramia compacta** var. **macowaniana**

Bartramia macowaniana C. Müll. in Hedwigia 38: 95 (1899); Broth. in Natürl. PflFam. 10: 457 (1924); Sim, Bryo. S. Afr. 303 (1926).

Stems mostly less than 5 mm long. *Seta* to 2 mm long; capsule just emergent.

Known only from the type locality in the southeastern corner of the central Cape Province. Map 163.

Voucher: *J. Sim* 10149.

Gametophytically this variety is indistinguishable from the typical variety. It is provisionally maintained at the rank of variety on the basis of its consistently short seta. This results in emergent capsules which are 'nestled' in the leaves along the stem and give the plants a rather distinctive appearance. The geographical isolation of the population is also interesting, however the plants have only been collected twice, in 1877 and 1921.

2. **Bartramia capensis** *(R. Br.) Wijk & Marg.* in Taxon 8: 71 (1959). Type: Cape, Table Mtn, *R. Brown* s.n. (BM!; MANCH!).

Glyphocarpa capensis R. Br. in Trans. Linn. Soc. Lond. 12: 575 (1819). *Gymnostomum capense* (R. Br.) Hook., Musci Exot. 2: 165 (1819). *Glyphocarpus capensis* (R. Br.) Brid., Bryol. Univ. 2: 91 (1827).

Bartramia quadrata Hook., Musci Exot. 2: 132 (1820). *Glyphocarpus quadratus* (Hook.) Brid., Bryol. Univ. 2: 92 (1827). Type: Cape, George, Auteniqualand, *Burchell* s.n. (E, holo.; BM!).

Bartramia sericea Hornsch., Hort. Phys. Berol. 63 (1820); Broth. in Natürl. PflFam. 10: 457 (1924); Sim, Bryo. S. Afr. 303 (1926). *Glyphocarpus sericeus* (Hornsch.) Jaeg. in Verh. St. Gall. naturw. Ges. 1873–74: 62 (1875) nom. illeg. Type: Cape, Devil's Peak, *Bergius* s.n., vide Wijk & Marg., Ind. Musc. 5: 334 (1969).

Bartramia inserta Sull. & Lesq. in Proc. Am. Acad. Arts Sci. 4: 279 (1859); Broth. in Natürl. PflFam. 10: 457 (1924). *Glyphocarpus insertus* (Sull. & Lesq.) Jaeg. in Verh. St. Gall. naturw. Ges. 1873–74: 62 (1875). Type: Cape, Simonstown, *C. Wright* s.n., 26 Oct. 1853 (FH, holo.!).

Breutelia aristaria (C. Müll.) Broth. var. *plumosa* Sim in Trans. R. Soc. S. Afr. 15: 312 (1926), vide Dix. in Trans. R. Soc. S. Afr. 8: 206 (1920) and C. Müll. in Hedwigia 38: 93 (1899). Type: Natal, Inanda, *Rehmann* 185 (G!).

Plants small, caespitose, light green; terricolous. *Stems* 5–8 mm high, sparsely branched, with reddish tomentum below; in section round, central strand small, inner cortical cells in 2–4 rows, large, thin-walled, outer cortical cells in 1–2 rows, stereids, dark red, epidermal cells fragile, thin-walled, quickly eroded and stem becoming fluted. *Leaves* erect-spreading to widespreading dry or wet; narrowly lanceolate to linear-lanceolate, (1,2–) 1,5 (–2,2) mm long, lamina unistratose; apex long-acuminate; margins ±plane, serrulate, frequently by projecting ends of adjoining cells. *Costa* excurrent to long-excurrent, superficial cells rectangular, smooth below, weakly prorate in upper leaf; in section rounded, bulging dorsally, guide cells 4, larger than other cells, incrassate, ventral stereid or substereid band 1–2 cells thick, exposed, dorsal stereid band 3 cells thick, rarely substereids, surface cells not differentiated. *Laminal cells* long-rectangular throughout, thickened, 7–12: 1, papillae few and somewhat scattered, over lumen or displaced toward proximal end; basal cells not strongly differentiated, mostly 10: 1, generally less than 15 cells wide on each side of costa; alar cells forming small group of quadrate cells, 2–3 cells wide by ±4 cells high.

Autoicous. Perigonia terminal on branches. Perichaetia terminal, leaves slightly shorter

FIG. 117.—**Bartramia compacta** (1–12): **1.** habit (var. **macowaniana**), × 1; **2.** habit (var. **compacta**), × 1; **3.** habit (var. **compacta**), × 5; **4.** part of stem in cross section, × 350; **5.** leaf, × 35; **6.** leaf in cross section, ×350; **7.** basal leaf cells (right side), × 175; **8.** laminal cells, × 700; **9.** leaf apex, × 175; **10.** exothecial cells, × 350; **11.** part of capsule mouth showing cells, × 350; **12.** spore, × 550. **B. capensis** (13–22): **13.** habit, × 1; **14.** habit, × 5; **15.** part of stem in cross section, × 350; **16.** leaf, × 35; **17.** leaf in cross section, × 350; **18.** basal leaf cells (right side), × 175; **19.** laminal cells at right margin, × 700; **20.** leaf apex, × 175; **21.** spore, × 550; **22.** part of capsule mouth showing cells, × 350. **B. aristaria** (23–29): **23.** habit, × 1; **24.** habit, × 5; **25.** leaves, × 35; **26.** leaf in cross section, × 350; **27.** basal leaf cells (right side), × 175; **28.** laminal cells at right margin, × 700; **29.** leaf apex, × 175. (1, *J. Sim* 10149; 2–12, *Garside* 6589a; 13–22, *Esterhuysen* 17438; 23–29, *Thorne* 50359).

and broader than vegetative leaves; ovate-acuminate, 1,5−2,0 mm long. *Seta* 5−10 mm long, reddish brown; capsule ±erect to inclined, urn globose and smooth wet, ±quadrate and sulcate dry, 1,0−1,2 mm long; exothecial cells oblong-hexagonal, thin-walled, at mouth with 4−5 rows of transversely rectangular cells; stomata present at base of urn, phaneropore; *peristome* absent, occasionally with whitish fringe at mouth; operculum conic to convex-apiculate; calyptra not seen; spores large, subround, 50 μm, warty, red-brown. Fig. 117: 13–22.

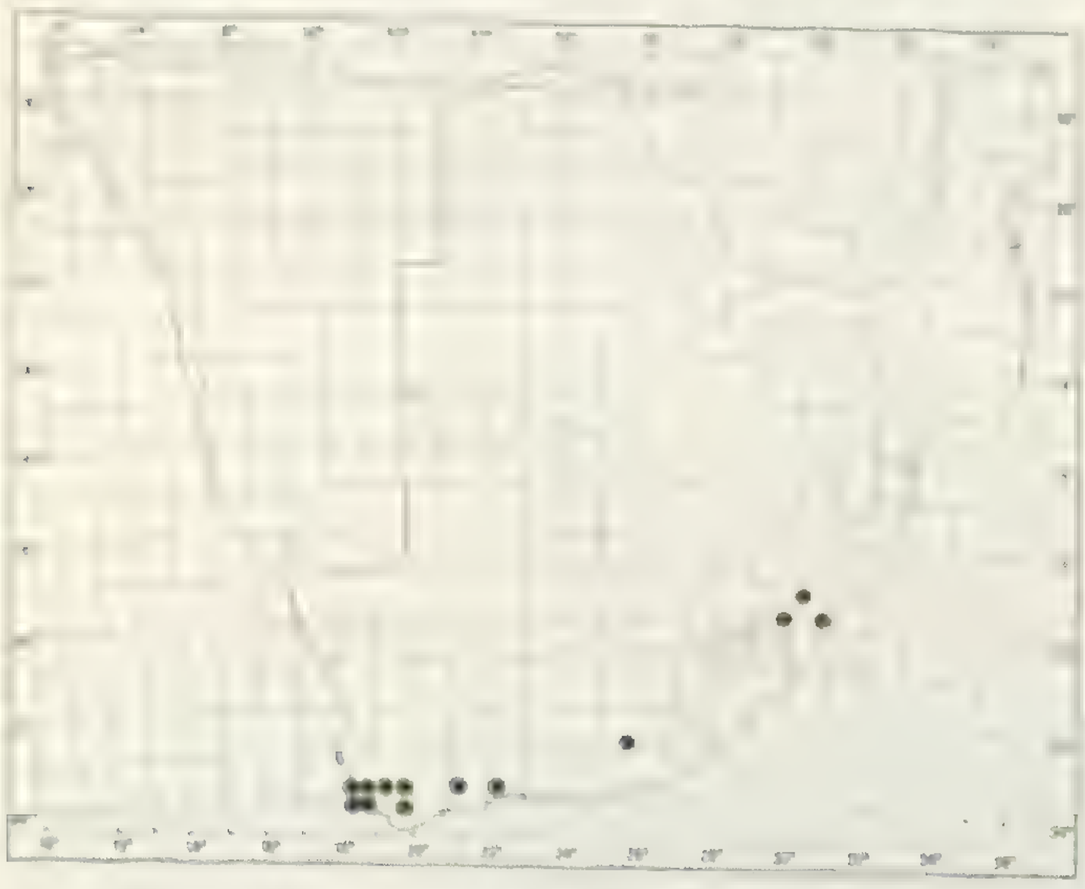
Endemic to southern Africa, the species is rare in the shrublands of the central, southern and southwestern Cape. A few specimens have also been found in Natal. Map 164.

Vouchers: *Stephens* PRE-CH9365; *Thomas* PRE-CH3393.

The relationship between *B. capensis* and *B. compacta* appears to be close since these species share many characters. The main differences are leaf shape and leaf position when dry, type and degree of leaf cell papillosity and to some extent leaf cell development. In addition the spores of *B. capensis* are nearly twice as large as those of *B. compacta*.

Bartramia capensis is unlikely to be confused with any other species, with the possible exception of *Anacolia breutelii*, however the bistratose upper lamina and strongly toothed leaf margins will separate that species.

The description of *B. inserta* as dioicous by Sullivant & Lesquereux (1859) [see also Sayre (1978)] is apparently incorrect. The perigonia are indeed terminal, but on elongated innovations clearly attached to stems with sporophytes. The compact tufting of the plants may account for Sullivant's observation, or perhaps some stems are initially terminated by perigonia. Recent examination of several specimens with sporophytes (including the type of *B. inserta*) clearly indicates that *B. capensis* is autoicous.



MAP 164.— ● **Bartramia capensis**

The relationship of *B. capensis* and *B. aristaria* is still in question; see note under that species.

3. **Bartramia aristaria** *C. Müll.* in Hedwigia 38: 93 (1899). Syntypes: Cape, Table Mountain, *Rehmann* s.n., Nov. 1875; Montagu Pass, *Rehmann* 184 (PRE!); Natal, Inanda, *Rehmann* 194 (PRE!); non *Rehmann* 185.

Breutelia aristaria (C. Müll.) Broth. in Natürl. PflFam. 1: 657 (1904); 10: 471 (1924); Sim, Bryo. S. Afr. 312 (1926).

Plants small to medium-sized, loosely caespitose, light green to yellow-green; terricolous. *Stems* 5−10 mm high, sparsely branched, tomentose below, reddish; in section round, central strand small, inner cortical cells in 3−4 rows, slightly thickened toward margin, outer cortical cells in 1−2 rows, stereids, reddish, epidermal cells larger, fragile, thin-walled. *Leaves* erect to spreading wet or dry; ovate-acuminate to ovate-lanceolate, 1,5−2,5(−3,0) mm long, lamina unistratose; apex acuminate; margins reflexed, serrate above, frequently bistratose. *Costa* excurrent to long-excurrent, superficial cells rectangular, weakly prorate above; in section bulging dorsally, guide cells 2−4, larger than other cells, ventral stereid band (1−)2−3 cells thick, exposed, dorsal stereid band 3−8 cells thick, occasionally substereids, surface cells not strongly differentiated. *Laminal cells* short-rectangular, incrassate, ± flexuose, 6−8:1, papillae generally over lumen; basal cells weakly differentiated, frequently papillose, generally 20 or more cells wide on each side of costa; alar cells occasionally distinct.

Autoicous. Perichaetia terminal, leaves ± broader. *Seta* 5−10 mm long, reddish; capsule inclined, urn globose wet, cylindrical-sulcate dry, 2 mm long, red-brown; exothecial cells oblong-hexagonal, thin-walled, 4−5 rows of transversely rectangular cells at mouth; stomata present at base of urn, phaneropore; *peristome* absent; operculum convex-apiculate; spores subround, to 50 μm, warty, brownish. Fig. 117: 23−29.

Endemic to southern Africa, this species is collected on soil and rock in grassland and shrublands of the southern and southwestern Cape, Natal and central and eastern Transvaal. Map 165.

Vouchers: *Bews* PRE-CH9700; *Esterhuysen* 17827; *Pillans* 4286.

MAP 165.— ● **Bartramia aristaria**

This species resembles a small *Breutelia* and was treated in that genus by Brotherus (1924) and Sim (1926); however, as Sim noted, the plants are very small for that genus and there is no indication of leaf plications.

The species seems to be related to *Bartramia capensis* and many specimens were previously identified as that species or one of its synonyms. The two species are similar in several sporophytic and gametophytic characters, but differ primarily in leaf shape, number of cells across leaf base, and leaf cell length and shape. These similarities strongly suggest the need for additional research into the relationship between the species.

4. **Bartramia hampeana** *C. Müll.* in Bot. Ztg 16: 162 (1858); Broth. in Natürl. PflFam. 10: 453 (1924); Sim, Bryo. S. Afr. 301 (1926); Catcheside, Moss. South Austr. 281 (1980). Type: Cape, Gnadenthal, *Breutel* s.n. (BM!).

Bartramia asperrima C. Müll. in Hedwigia 38: 94 (1899), hom. illeg., non (Britt.) C. Müll. (1897); Broth. in Natürl. PflFam. 10: 453 (1924). Type: Cape, Gnadenthal, *Breutel* s.n. (BM!).

Bartramia penicillata C. Müll. in Hedwigia 38: 94 (1899); Broth. in Natürl. PflFam. 10: 453 (1924). Type: Somerset East, Boschberg, *MacOwan* s.n., 1878 (GRA!).

Bartramia ramentosa C. Müll. in Hedwigia 38: 94 (1899); Broth. in Natürl. PflFam. 10: 456 (1924). Syntypes: Transvaal, Lydenburg, *Wilms* s.n., Apr. 1887 (G!); Cape, Somerset East, Boschberg, *MacOwan* s.n.

Plants small to medium-sized, loosely caespitose, yellow-green to glaucous green; terricolous or saxicolous. *Stems* (3–)8–30(–60) mm high, irregularly branched; in section round, central strand present, inner cortical cells in 3–5 rows, large, thin-walled, outer cortical cells in 1–2 rows, stereids, dark red or occasionally weakly thickened and undifferentiated, epidermal cells differentiated, slightly larger, thin-walled, frequently broken away and stem weakly fluted. *Leaves* generally compact, generally appressed dry, erect to erect-spreading or occasionally widespreading wet; linear above oblong to obovate base, (1,5–)2,5–4,0 (–5,0) mm long, bistratose above base; apex subulate, frequently fragile, ± flexuose above; base sheathing, hyaline, abruptly narrowing to subula, occasionally not as distinct in smaller plants; margins plane, distinctly serrate to denticulate, unistratose. *Costa* percurrent to short-excurrent as serrate awn, superficial cells long-rectangular, prorate; in section elliptical, guide cells 6–12, ventral stereid band 1–3 cells thick, occasionally substereids, ventral surface cells strongly incrassate, smaller than guide cells, rounded but sharply bulging at ends (prorate), dorsal stereid band 3–8 cells thick, dorsal surface cells strongly incrassate, rounded but bulging outward at prorate cell ends, occasionally not differentiated. *Laminal cells* rectangular to long-rectangular, 2–8:1, weakly thickened, sharply prorate at both ends; basal cells highly differentiated, long-rectangular, 10–15:1, thin-walled, hyaline, smooth, ± glossy.

Dioicous. Perichaetia lateral through innovation, leaves not differentiated. *Seta* variable in length, 4–10(–15) mm long, yellowish; capsule suberect to inclined, urn subglobose to broadly short-cylindrical, 1,5–2,2 mm long, sulcate dry, occasionally weakly ribbed wet, yellowish with reddish mouth; exothecial cells subrhomboidal to hexagonal, thin-walled, 3–4 rows at mouth transversely rectangular; stomata present at base of urn, phaneropore; *peristome* absent, occasionally with hyaline fringe at mouth; operculum conic to convex-apiculate; calyptra not seen; spores subround, 30–37 μm, warty, reddish brown. Fig. 118.

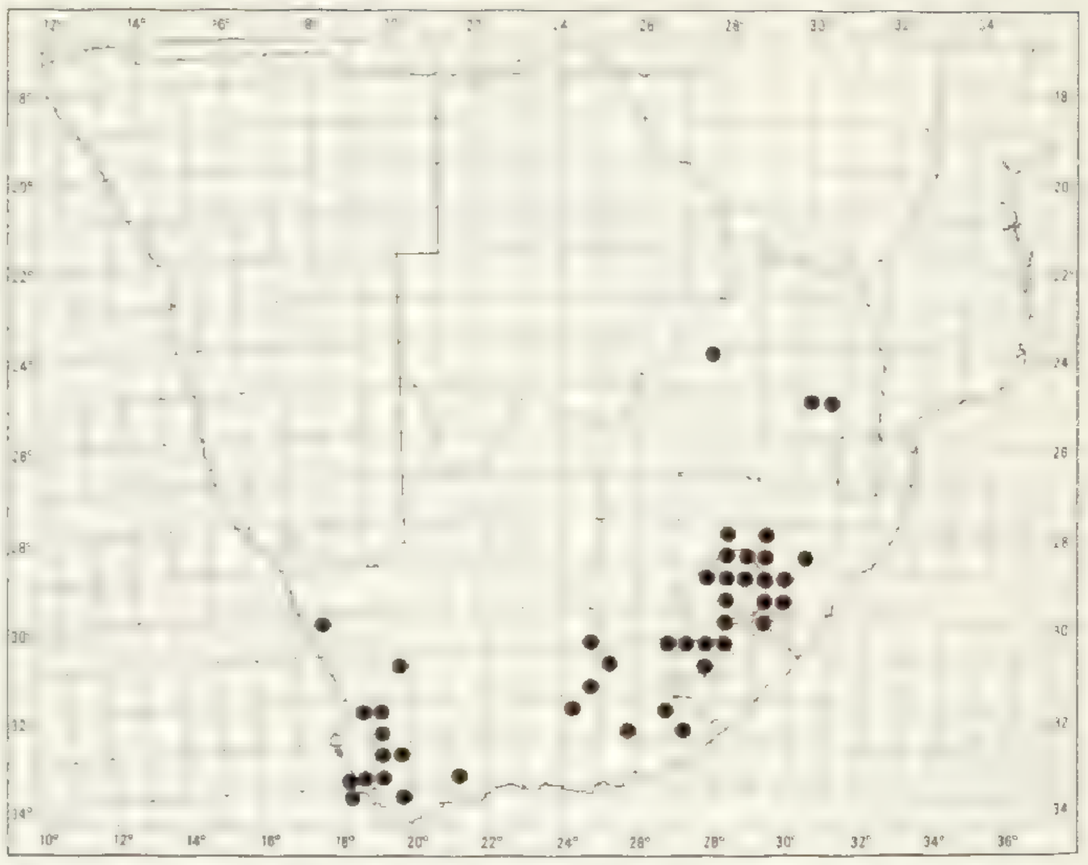
Presently recognized only from southern Africa. *B. hampeana* is now believed to be conspecific with the Australian species *B. hampei* (C. Müll.) Catcheside. In southern Africa, *B. hampeana* is found on soil and rock in shrublands or grasslands of mountains in the northwestern, southwestern, central, southern and eastern Cape, Lesotho, Natal, Orange Free State and the eastern and central Transvaal. Map 166.

Vouchers. *Esterhuysen* 24410; *Hilliard & Burtt* 12222, 125742; *Magill* 4155, 4699, 5788, 5906; *Rankin* 78; *Schelpe* 7684; *Smook* 1723; *Van Rooy* 317; *Van Zanten et al.* 76091011.

This is the only southern African species of *Bartramia* with the highly differentiated leaf base of the 'vaginella' group. In most specimens the hyaline, sheathing base, that abruptly constricts to a long, narrow subula, is obvious even on leaves still attached to the stem. Some smaller specimens

FIG. 118.—**Bartramia hampeana: 1.** habit, × 1; **2.** habit, × 4; **3.** leaves, × 35; **4.** leaf, × 35; **5.** leaf in proximal cross section, × 350; **6.** leaf in distal cross section, × 350; **7.** basal leaf cells (right side), × 175; **8.** basal leaf cells, × 700; **9.** laminal cells at upper right margin, × 700; **10.** leaf apex, × 175; **11.** part of capsule mouth showing cells, × 350. (1–11, *Barnard* 50345).

do not have the pronounced shoulders of the constriction. These specimens do, however, exhibit the strongly differen-



MAP 166.— ● **Bartramia hampeana**

tiated basal leaf cells, as well as other characters specific to *B. hampeana*.

The seta of *B. hampeana* is quite variable in length, although there appears to be a continual gradation in lengths, unlike the situation in *B. compacta*. The sporophytes are quickly overgrown by subperichaetial innovations, thus even capsules with longer seta appear emergent as the cushions enlarge. The few plants with very long seta have short stems and almost no branches. These plants at first appear distinct, but do not differ in other respects.

Insufficiently Known Species

Bartramia delagoae C. Müll. in Hedwigia 38: 92 (1899). *Philonotis delagoae* (C. Müll.) Par., Ind. Bryol. Suppl. 266 (1900); Broth. in Natürl. PflFam. 10: 462 (1924); Dix. in Trans. R. Soc. S. Afr. 8: 205 (1920). Type: Transvaal, Omtombi, Delagoa Bay to Lydenburg, *Wilms* s.n., Aug. 1884 (Herb. Jack). The type of this species has not been located.

Bartramia spielhausii C. Müll. in Hedwigia 38: 91 (1899). *Breutelia spielhausii* (C. Müll.) Par., Ind. Bryol. Suppl. 54 (1900); Broth. in Natürl. PflFam. 10: 471 (1924). Syntypes: Cape, Table Mountain, *Spielhaus* s.n. (Herb. Brämer); Somerset East, Boschberg, *MacOwan* s.n., 1883. A type has not been located. Dixon (1920) indicated that this species (from description only) was not distinct from *Rehmann* 185 (type of *Breutelia aristaria* var. *plumosa* Sim—synonym of *Bartramia capensis*).

4. CONOSTOMUM

Conostomum *Sw.* in Web. & Mohr., Naturh. Reise Schwedens 122 (1804); Broth. in Natürl. PflFam. 10: 457 (1924); Sainsb., N. Zeal. Mosses 305 (1955); Smith, Moss Fl. Brit. Irel. 458 (1978). Type species: *C. arcticum* Sw.

Plants small to medium-sized, densely caespitose; terricolous or saxicolous. Stems erect, branched but with few subperichaetial innovations, densely tomentose below; in section rounded, central strand present, epidermal cells differentiated. *Leaves* in 5 distinct rows, imbricate wet or

dry; triangular to oblong-lanceolate; margins reflexed and serrate at apex; lamina bistratose juxtacostally. *Costa* short-excurrent. *Laminal cells* rhomboidal to rectangular, smooth below, strongly prorate near apex; basal cells rectangular, smooth.

Autoicous. *Seta* flexuose; capsule oval, sulcate dry; peristome single, teeth joined at apex; operculum rostrate; spores with bulging plates, ± warty.

A genus of 15 species found at high altitude in mountainous regions; primarily in the Southern Hemisphere. This is the first report of the genus for Africa. The specimens were collected in the alpine grass-heathlands of northern Lesotho and the Drakensberg of Natal.

The genus should not be confused with any other genus of Bartramiaceae, although the prorate laminal cells, spore ornamentation and capsule structure clearly indicate the relationship of *Conostomum* to other members of the family.

Conostomum pentastichum *(Brid.) Lindb.* in Öfvers. K. VetenskAkad. Förh. 20: 392 (1863). Type: South America, Chile.

Bartramia pentasticha Brid., Musc. Rec. 2: 134 (1803).

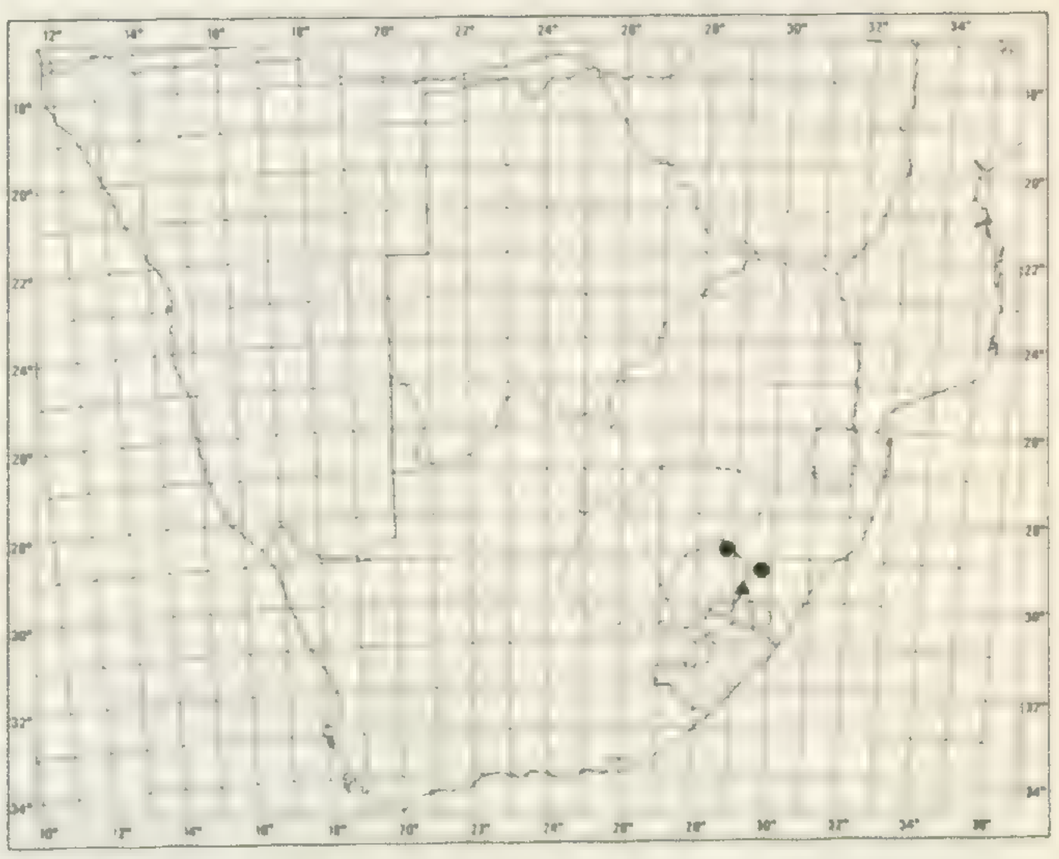
Plants small to medium-sized, forming dense cushions, yellow-brown to yellow-green, brownish below; terricolous or saxicolous. *Stems* 5–10 (–15) mm tall, irregularly branched, tomentum dense on lower stem, red-brown; in section subround to angular, central strand small, inner cortical cells in 3 rows, large, thin-walled, outer cortical cells in 2 rows, thickened or substereids, red-yellow, epidermal cells large, thin-walled, fragile, stem becoming fluted. *Leaves* crowded, erect-appressed in 5 distinct rows wet or dry; narrowly triangular to oblong-lanceolate, 1,0–1,2 mm long, lamina bistratose juxtacostally from base; cells with strongly thickened adjoining walls, outer walls thin, bulging, 4–8 rows at margin unistratose, cells rounded, ± evenly thickened; apex acute, toothed; margins plane below, weakly reflexed above, entire, serrate near apex. *Costa* short-excurrent as smooth awn, 0,2–0,3 mm long, ventral superficial cells rectangular, weakly prorate and ± thickened near apex, dorsal superficial cells rectangular, strongly prorate at distal ends and ± thickened near apex; in section guide cells not well defined, ± 6, substereids, ventral cells in single layer continuous with upper layer of lamina, cells enlarged, inner walls strongly thickened, outer walls very thin-walled, dorsal substereid band 2 cells thick, dorsal surface cells continuous with lower layer of lamina, similar to ventral surface cells. *Upper laminal cells* rhomboidal to fusiform or narrow-rectangular, 7–10: 1, becoming weakly thickened and distally prorate above, slightly narrower toward margin; basal cells rectangular, 2–5: 1, thin-walled, smooth.

Perigonia terminal on branches, leaves elliptical, yellowish; costa short-excurrent. Perichaetia terminal, leaves similar to vegetative leaves or slightly broader; laminal cells narrow, thin-walled. *Seta* 3–4 mm long, flexuose, yellow-brown; capsule suberect, urn oval-orbicular wet, elliptical and sulcate dry, 1,5 mm long, red-brown; exothecial cells hexagonal to oblong-hexagonal, 2 rows smaller and quadrate at mouth; stomata present at base of urn, phaneropore; *peristome* single, fragile, red-yellow, teeth 16, linear, smooth, joined at apex; operculum obliquely rostrate; calyptra not seen; spores oval-reniform, 50–60 μm, reddish brown, with low, bulging, ± hexagonal plates covering distal surface. Fig. 119.

New to southern Africa, *C. pentastichum* is found in South America, Tasmania, New Zealand and a few subantarctic islands. In the Flora area the species is found on soil and rock in the alpine grass-heathlands of northern Lesotho and the Drakensberg of Natal. Map 167.

Vouchers: *Magill* 7130A; *Van Zanten et al.* 7609961, 7609977 c. fr.

The unusual rigid ranking of the leaves up the stem, and shape of leaves and leaf cells should place specimens of *C. pentastichum*. The southern African plants are at the lower limits of measurements published for New Zealand plants (Sainsbury, 1955) where stems reach 40 mm high and the seta and capsules are 10–35 mm and 1,5–3,5 mm long, respectively.



MAP 167.— ● **Conostomum pentastichum**
▲ **Quathlamba debilicostata**

Fig. 119

Fig. 120

5. QUATHLAMBA

Quathlamba *Magill*, gen. nov., *plantae parvae, laxe caespitosae, subvirides; terricolae*. Caules *infra perichaetia ramificantes*. Folia *ovata, appressa*. Costa *destituta vel rudimentalis*. Cellulae laminae *leves*.

Perichaetia terminalia; folia costata. Theca *exserta globosa, orificio parvo, peristomio destituto, operculo plane-convexo; calyptra parva cucullata; sporae verrucatae*.

Type species: *Q. debilicostata* Magill.

Plants small, forming loose tufts, light green; terricolous. *Stems* branching by subperichaetial innovations. *Leaves* ovate, appressed. *Costa* absent or rudimentary. *Laminal cells* smooth.

Perichaetia terminal, leaves costate. *Capsule* exserted, globose, mouth small; peristome absent; operculum plano-convex; calyptra small, cucullate; spores warty.

Quathlamba, barrier of uppointed spears, is the Zulu name for the Drakensberg, habitat of the genus.

Quathlamba debilicostata *Magill*, sp. nov. *bene distincta plantis parvis, foliis ovato-acutis, 0,5–0,7 mm longis, costis destitutis vel rudimentalibus, cellulis laminae levibus, capsulis globularibus, peristomio destituto et sporis verrucatis*.

Type: Lesotho, top of Sani Pass, on soil of rock crevices along northern cliff face just E of Mountain Lodge, 2860 m, *Magill* 4512 (MO, holo.; PRE).

Plants small, in loose tufts or cushions, light green above, tan below; terricolous. *Stems* erect, 5–15 mm high, julaceous, branching by subperichaetial innovations; in section round, central strand small, cortical cells in 3–4 rows, undifferentiated. *Leaves* crowded above, erect-appressed wet or dry; ovate to elliptical or oblong-elliptical, 0,5–0,7 mm long; apex acute, very weakly concave; margins plane, entire. *Costa* absent or rudimentary, when present consisting of a few elongated or brownish cells extending into lower ⅓ of leaf; in section with a single dorsal and ventral cell, both smaller than cells of lamina. *Laminal cells* irregular, rhomboidal to rectangular, 50–75 μm × 25 μm, thin-walled or occasionally weakly thickened, smooth; basal cells rectangular to short-rectangular, 30–75 μm × 25 μm; thin-walled.

Autoicous. Antheridia axillary in uppermost leaves. Perichaetia terminal but quickly overgrown by subperichaetial innovations; leaves ovate-acuminate, 0,75–1,50 mm long; costa present, weak to above midleaf; in section with 2–3 cells ventrally and 3–4 cells dorsally; laminal cells rectangular to long-rectangular, weakly thickened. *Seta* 1,5–2,0 mm long, light brown; capsule exserted, erect, gymnostomous, urn globose wet, sulcate dry, 1,8–2,2 mm long, light brown, mouth small; exothecial cells angular, ± subquadrate to rectangular, thin-walled, 3–4 rows of transversely rectangular, thickened cells at mouth, dark brown; stomata in two rows at base of urn, phaneropore; *peristome* absent; operculum plano-convex; calyptra quickly lost, small, cucullate, 0,7 mm long, dark brown, appearing leathery; spores rounded but flattened to concave on proximal face, 50 μm, warty, yellow-brown. Fig. 120.

Endemic to southern Africa, the species is found on soil in rock crevices of cliffs in the alpine heathland at Sani Pass, Lesotho. Map 167.

Vouchers: *Magill* 4443, 4485, 7154a.

Gametophytically these plants are very unusual in the family, but the globose urn with small mouth and warty spores and two guard cells per stoma indicate its relationship to other members of Bartramiaceae.

FIG. 119.—**Conostomum pentastichum: 1.** habit, × 1; **2.** habit, × 5; **3.** stem in cross section, × 350; **4.** leaves, × 70; **5.** leaf in cross section, × 175; **6.** basal leaf cells (left side), × 175; **7.** upper laminal cells at left margin (dorsal surface), × 350; **8.** upper laminal cells (dorsal surface), × 700; **9.** leaf apex, × 700; **10.** upper exothecial cells, × 175; **11.** part of capsule mouth, showing cells and broken peristome, × 175. (1–11, *Van Zanten* 7609977).

FIG. 120.—**Quathlamba debilicostata: 1.** habit, × 1; **2.** habit, × 10; **3.** stem cross section, × 175; **4 & 5.** leaves, × 35; **6.** leaves in cross section, × 175; **7.** basal leaf cells, × 175; **8.** leaf apex, × 175; **9.** perichaetial leaf, × 35; **10.** part of capsule mouth with spores, × 70; **11.** spore, × 700. (1–11, *Magill* 4512).

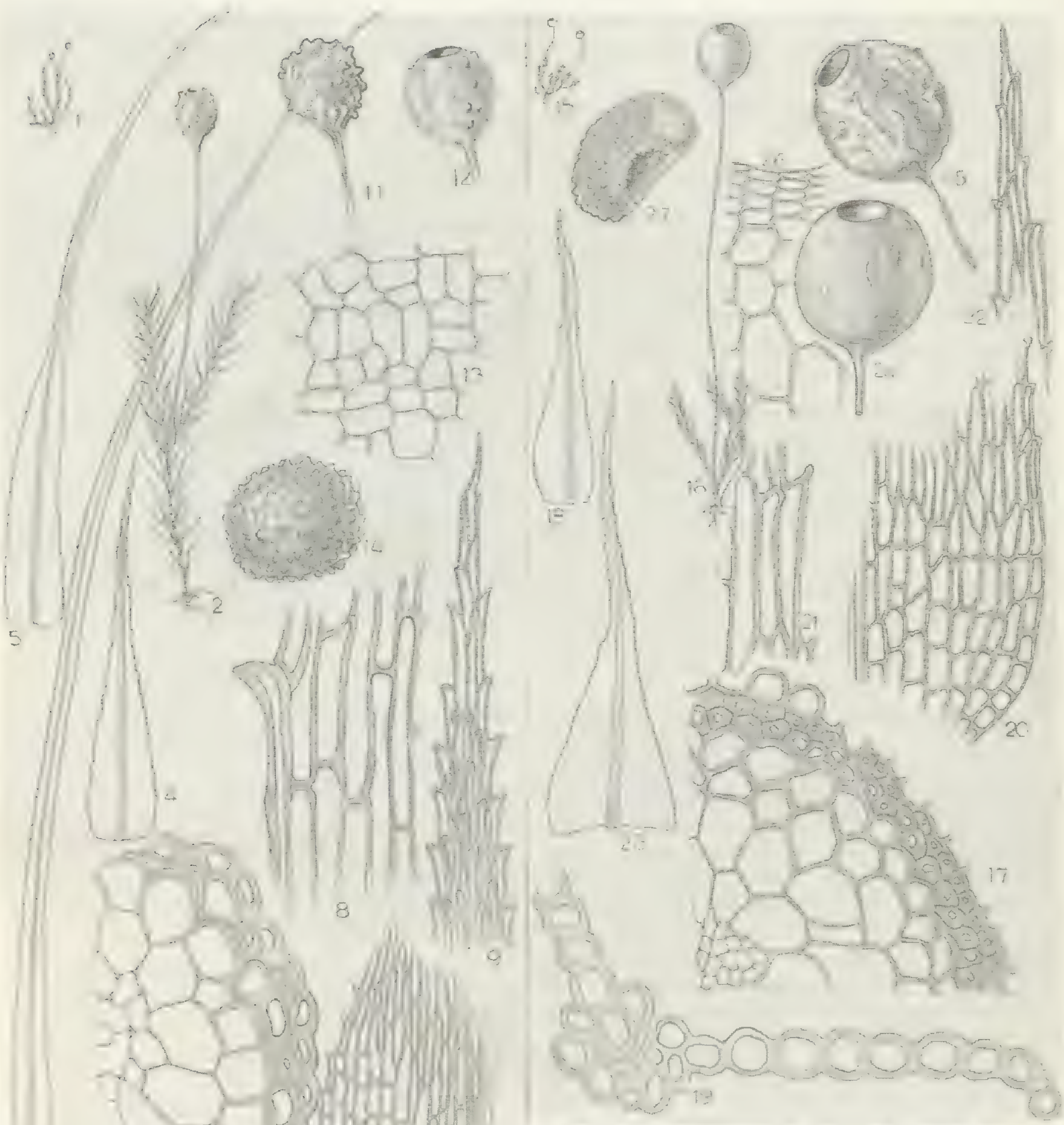


FIG. 121.—**Bartramidula comosa** (1–14): **1.** habit, × 1; **2.** habit, × 5; **3.** part of stem in cross section, × 700; **4.** stem leaf, × 35; **5.** subperichaetial leaf, × 35; **6.** leaf in cross section, × 700; **7.** basal leaf cells (left side), × 175; **8.** laminal cells at left margin, × 700; **9.** leaf apex, × 175; **10.** perichaetial leaf, × 35; **11.** capsule, dry, × 10; **12.** capsule, wet, × 10; **13.** exothecial cells, × 175; **14.** spore, × 450. **B. globosa** (15–27): **15.** habit, × 1; **16.** habit, × 5; **17.** part of stem in cross section, × 700; **18.** leaf, × 35; **19.** leaf in cross section, × 700; **20.** basal leaf cells (right side), × 175; **21.** laminal cells at right margin, × 700; **22.** leaf apex, × 175; **23.** perichaetial leaf, × 35; **24.** capsule, wet, × 10; **25.** capsule, dry, × 10; **26.** part of capsule mouth showing cells, × 175; **27.** spore, × 450. (1–14, *Esterhuysen* PRE-CH12606; 15–27, *Oliver* 6793).

6. BARTRAMIDULA

Bartramidula *B.S.G.*, Bryol. Eur. 4: 55 (1846), nom. cons.; Broth. in Natürl. PflFam. 10: 459 (1924); Sim, Bryo. S. Afr. 304 (1926); Flowers in Grout, Moss Fl. N. Amer. 2: 163 (1935); Smith, Moss Fl. Brit. Irel. 458 (1978); Catcheside, Moss. South Austr. 285 (1980). Lectotype species: *B. wilsonii* B.S.G., fide Flowers in Grout, Moss Fl. N. Amer. 2: 163 (1935).

Plants small, caespitose or in small groups; terricolous. *Stems* sparsely branched by subperichaetial innovations; central strand large, epidermis differentiated. *Leaves* linear-lanceolate to ovate-acuminate, margins serrate. *Costa* short-excurrent. *Laminal cells* narrowly rectangular, incrassate, prorate; basal cells rectangular, smooth.

Dioicous or synoicous. Perichaetia becoming lateral through innovation; leaves ovate-acuminate or strongly differentiated, long-linear. *Seta* elongate; capsule erect, symmetrical, round, smooth or warty, little altered dry; peristome absent; spores papillose or warty.

The 21 species of *Bartramidula* are evenly distributed in temperate and tropical regions of the world. The two southern African species could easily be mistaken for species of *Philonotis* when sporophytes are absent.

1 Capsule wall warty; spore surface warty ..... 1. *B. comosa*
1 Capsule wall smooth; spore surface papillose ..... 2. *B. globosa*

1. **Bartramidula comosa** *(Hampe & C. Müll.) Broth.* in Natürl. PflFam. 1: 644 (1904); 10: 460 (1924); Sim, Bryo. S. Afr. 304 (1926). Type: Cape, Houteniqua, Montagu Pass, *Breutel* s.n. (BM!).

Bartramia comosa Hampe & C. Müll. in Bot. Ztg 17: 221 (1859), hom. illeg., non Mitten (1859).

Plants small, loosely caespitose or in small groups, yellowish green; terricolous. *Stems* erect, to 5 mm high, usually with a few subperichaetial branches; in section round, central strand large, inner cortical cells in 2–3 rows, large, thin-walled; outer cortical cells in 1–2 rows, smaller, incrassate, reddish, epidermal cells thin-walled. *Leaves* somewhat crowded, appressed to erect dry, erect wet; narrowly lanceolate, 1,0–1,2(–1,5) mm long; apex acuminate to subulate; margins plane, serrate above base. *Costa* short-excurrent, serrate; in section rounded, bulging dorsally, guide cells 2, incrassate, ventral cells in single layer, similar to guide cells, incrassate, dorsal stereid band small, of 4–8 cells, dorsal surface cells similar to ventral cells. *Laminal cells* linear-rectangular, 4–6: 1, incrassate, weakly prorate; basal cells slightly wider, 2–4: 1, smooth.

Dioicous. Perichaetia terminal or lateral through innovation; leaves strongly differentiated, long-linear, 4–5 mm long; margins weakly serrate, teeth distant; costa excurrent; laminal cells linear, mostly smooth. *Seta* 3–6 mm long, yellowish to reddish yellow; capsule erect, symmetrical, urn globose, warty, to 1 mm long, yellowish to brownish; exothecial cells irregularly arranged, quadrate to rectangular or oblong-hexagonal or occasionally transversely rectangular, warty protuberances on capsule wall multicellular, 4–6 rows of short, transversely rectangular cells at capsule mouth; stomata present at base of urn, phaneropore; *peristome* absent; operculum plano-convex; only juvenile calyptra seen, cucullate, apparently quickly lost; spores subround, 35–42 μm, densely warty, brownish. Fig. 121: 1–14.

Endemic to southern Africa, *B. comosa* is collected on soil in mountains of the southern and southwestern Cape. Map 168.

Voucher: *Esterhuysen* 24360.

Vegetatively similar to *B. globosa;* the narrower leaves, differences in costal anatomy and more strongly thickened leaf cells will help to separate sterile specimens of *B. comosa*. Sporophytically this species is very distinctive with its very long-linear perichaetial leaves, warty capsule and large warty spores.

2. **Bartramidula globosa** *(C. Müll.) Broth.* in Natürl. PflFam. 1: 644 (1904); 10: 460 (1924); Sim, Bryo. S. Afr. 305 (1926). Type: Cape, Gnadenthal, *Breutel* s.n., 1856 (BM!).

Bartramia globosa C. Müll. in Hedwigia 38: 90 (1899).

MAP 168.— ● **Bartramidula globosa**
▲ **Bartramidula comosa**

Bartramia globosa var. *tenuicaulis* C. Müll. in Hedwigia 38: 90 (1899). *Bartramia sordida* C. Müll., Gen. Musc. Fr. 335 (1900). *Bartramidula globosa* var. *tenuicaulis* (C. Müll.) Sim, Bryo. S. Afr. 305 (1926). Type: not designated.

Plants small, loosely caespitose or forming turfs, green to yellow-green; terricolous or saxicolous. *Stems* erect, (2–) 4–8 (–10) mm high, branching by subperichaetial innovations, weakly tomentose below; in section round, central strand large, innner cortical cells in 2–4 rows, large and thin-walled, but outer row smaller, outer cortical cells in 1–2 rows, stereids or substereids, reddish, epidermal cells medium-sized, thin-walled, frequently collapsed or eroded producing fluted stem. *Leaves* somewhat crowded, appressed to erect dry, erect-spreading wet; narrowly lanceolate or occasionally ovate-acuminate, 0,8–1,4 mm long; apex acuminate; margins plane to weakly reflexed, sharply serrate above. *Costa* short excurrent as serrate awn or occasionally only percurrent, filling acumen; in section rounded, bulging dorsally, guide cells 2, incrassate, ventral cells 2, in single layer, similar to guide cells, weakly thickened, dorsal stereid band 1–2 cells thick, frequently with distinct gap below guide cells, dorsal surface cells similar to ventral cells. *Laminal cells* linear-rectangular, 8–10: 1, incrassate, distinctly prorate in upper leaf; basal cells in distinct group, rectangular, 2–4: 1, slightly bulging, weakly thickened.

Synoicous. Perichaetia terminal or lateral through innovation; leaves ovate to short-oblong, acuminate, to 2 mm long, laminal cells rectangular. *Seta* 7–12 mm long, reddish yellow; capsule erect, symmetrical, urn globose, 1,5–2,0 mm long, ± smooth, little altered to wrinkled dry, mouth small; exothecial cells oblong-hexagonal, thin-walled, becoming quadrate above, 3–4 rows at mouth transversely rectangular; stomata numerous at base of urn, phaneropore; peristome absent, frequently with white fringe in mouth; operculum plano-convex; calyptra not seen; spores subround to reniform, 37–42 μm, weakly papillose, yellow-brown. Fig. 121: 15–27.

Endemic to southern Africa, *B. globosa* is found on soil and rock in the central, southwestern, southern and eastern Cape, Natal, Lesotho, eastern Orange Free State and the central and northern Transvaal. Map 168.

Vouchers: *Magill* 4449; *Schelpe* 7558; *Van Rooy* 467.

Sterile specimens are practically indistinguishable from *Philonotis dregeana*. The erect, symmetrical, globose capsules, with small mouths, will help to identify specimens of *B. globosa*. In addition the capsules are inflated and ± smooth wet or dry, a distincitive feature within the family. The two southern African species of *Bartramidula* are most easily identified by their sporophyte characters, which will also separate the species from other members of the family.

7. PHILONOTIS

Philonotis *Brid.*, Bryol. Univ. 2: 15 (1827); Broth. in Natürl. PflFam. 10: 460 (1924); Sim, Bryo. S. Afr. 305 (1926); Flowers in Grout, Moss Fl. N. Amer. 2: 164 (1935); Sainsb., N. Zeal. Mosses 310 (1955); Gangulee, Moss. E. India 4: 1108 (1974); Scott & Stone, Moss. S. Austr. 336 (1976); Smith, Moss Fl. Brit. Irel. 459 (1978); Catcheside, Moss. South Austr. 288 (1980). Lectotype species: *P. fontana* (Hedw.) Brid., fide Flowers in Grout, Moss Fl. N. Amer. 2: 164 (1935).

Plants small to medium-sized, rarely large, caespitose, green to yellowish green, occasionally bluish green; terricolous or saxicolous. *Stems* erect, branching by numerous, generally whorled, subperichaetial innovations; central strand present, epidermal cells large, thin-walled, fragile.

Leaves ovate to lanceolate; apex acute to acuminate, occasionally obtuse to rounded; base scarcely differentiated; margins plane to strongly recurved, entire to crenulate or doubly serrate. *Costa* subpercurrent to short-excurrent. *Laminal cells* short-rectangular to linear, incrassate, smooth, papillose or prorate; basal cells usually slightly larger, rectangular, thin-walled, generally smooth.

Autoicous or dioicous. Perigonia terminal, budlike or discoid with leaves abruptly narrowed and reflexed above broad sheathing base. Perichaetia terminal, quickly overgrown by subperichaetial branches. *Seta* elongate; capsule inclined, globose to ovoid wet, sulcate dry; peristome double, endostome with segments and cilia, occasionally rudimentary; operculum convex to conic; spores rounded to reniform, papillose.

Philonotis is a widespread genus with just over 170 species. Specimens are commonly collected on shallow soil or rock, especially in association with seepage areas, at the back of waterfalls or on marshy ground.

To accommodate the unusually large amount of gametophytic variation exhibited by specimens of *Philonotis*, a broad approach to the circumscription of species has been adopted. This variation is frequently expressed in leaf size and shape, leaf cell size and ornamentation (both between individual plants in a specimen and between fertile and sterile collections) and plant size and degree of branching.

Although the situation has been rationalized at the species level, a number of problems still exist, e.g. separation of sterile specimens of *Philonotis dregeana* and *Bartramidula globosa;* relationship between *P. dregeana* and *P. afrocapillaris*. Solution to the problem of infraspecific variation will require considerable research, including cultivation experiments. For instance differences in appearance between smooth to weakly papillose specimens and strongly papillose forms are very striking, but apparently a result of environmental differences.

1 Leaf cells papillose or prorate:
  2 Leaf margins plane; leaves frequently keeled ..... 4. *P. falcata*
  2 Leaf margins reflexed below, recurved to revolute above:
    3 Leaf cells short-rectangular, prorate; plants yellow-green ..... 3. *P. africana*
    3 Leaf cells quadrate to hexagonal, papilla over lumen; plants with glaucous bloom..... 5. *P. scabrifolia*

1 Leaf cells smooth or some cells weakly prorate:
  4 Leaves with border of narrow, elongated cells.....6. *P. vagans*
  4 Leaves without border:
    5 Leaf cells ± lax, rectangular to oblong-hexagonal; costa generally ending below apex .....2. *P. hastata*
    5 Leaf cells regularly narrow-rectangular, generally incrassate; costa short-excurrent..... 1. *P. dregeana*

1. **Philonotis dregeana** *(C. Müll.) Jaeg.* in Verh. St Gall. naturw. Ges. 1873–74: 89 (1875); Broth. in Natürl. PflFam. 10: 463 (1924). Type: Cape [*Bartramia* sp. coll. Dregeana III. A,e,9], *Drège* s.n. (G!).

Bartramia dregeana C. Müll. in Bot. Ztg 14: 419 (1856).

Bartramia androgyna Hampe in Bot. Ztg 28: 34 (1870). *Philonotis androgyna* (Hampe) Jaeg. in Verh. St Gall. naturw. Ges. 1873–74: 89 (1875); Sim, Bryo. S. Afr. 306 (1926). Type: Natal, Umpumulo, *Borgen* s.n., 20 Mar. 1867 (BM, holo.!).

Bartramia afrouncinata C. Müll. in Hedwigia 38: 91 (1899); Dix. in J. Bot., Lond. 62: 235 (1924); Sim, Bryo. S. Afr. 307 (1926). *Philonotis afrouncinata* (C. Müll.) Par., Ind. Bryol. Suppl. 265 (1900); Broth. in Natürl. PflFam. 10: 463 (1924). Type: Cape, *MacOwan* s.n., 1876 (? G!).

Bartramia afrouncinata var. *gracilescens* C. Müll. in Hedwigia 38: 92 (1899). *Philonotis afrofontana* var. *gracilescens* (C. Müll.) Par., Ind. Bryol. Suppl. 265 (1900); Dix. in Trans. R. Soc. S. Afr. 8: 205 (1920); Sim, Bryo. S. Afr. 307 (1926). *Bartramia gracilescens* (C. Müll.) C. Müll., Gen. Musc. Fr. 339 (1900). Type: Cape, Boschberg, *MacOwan* s.n., 1874 (G!).

Bartramia pernana C. Müll. in Hedwigia 38: 92 (1899). *Philonotis pernana* (C. Müll.) Par., Ind. Bryol. Suppl. 267 (1900). Type: Cape, prope Belweder, *Rehmann* 191, fide Dix. & Gepp (1923).

Philonotis afrocapillaris Dix. ex Sim, Bryo. S. Afr. 309 (1926). Type: Cape, Wilderness, George, *Taylor* sub *Sim* 10153 (BM, holo.!; PRE!).

Plants small to medium-sized, caespitose, light green to yellow-green; terricolous. *Stems* (5–)10–30(–50) mm high, branched by subperichaetial innovations; in section round, central strand small, inner cortical cells in 2 rows, thin-walled, outer cortical cells in 1–2 rows, incrassate, red-yellow, epidermal cells quickly eroded. *Leaves* appressed or reflexed dry, erect-spreading wet; ovate-lanceolate, 0,5–1,5 mm long; apex acuminate; margins plane to reflexed, serrate to doubly serrate. *Costa* short-excurrent as serrate awn, filling acumen above;

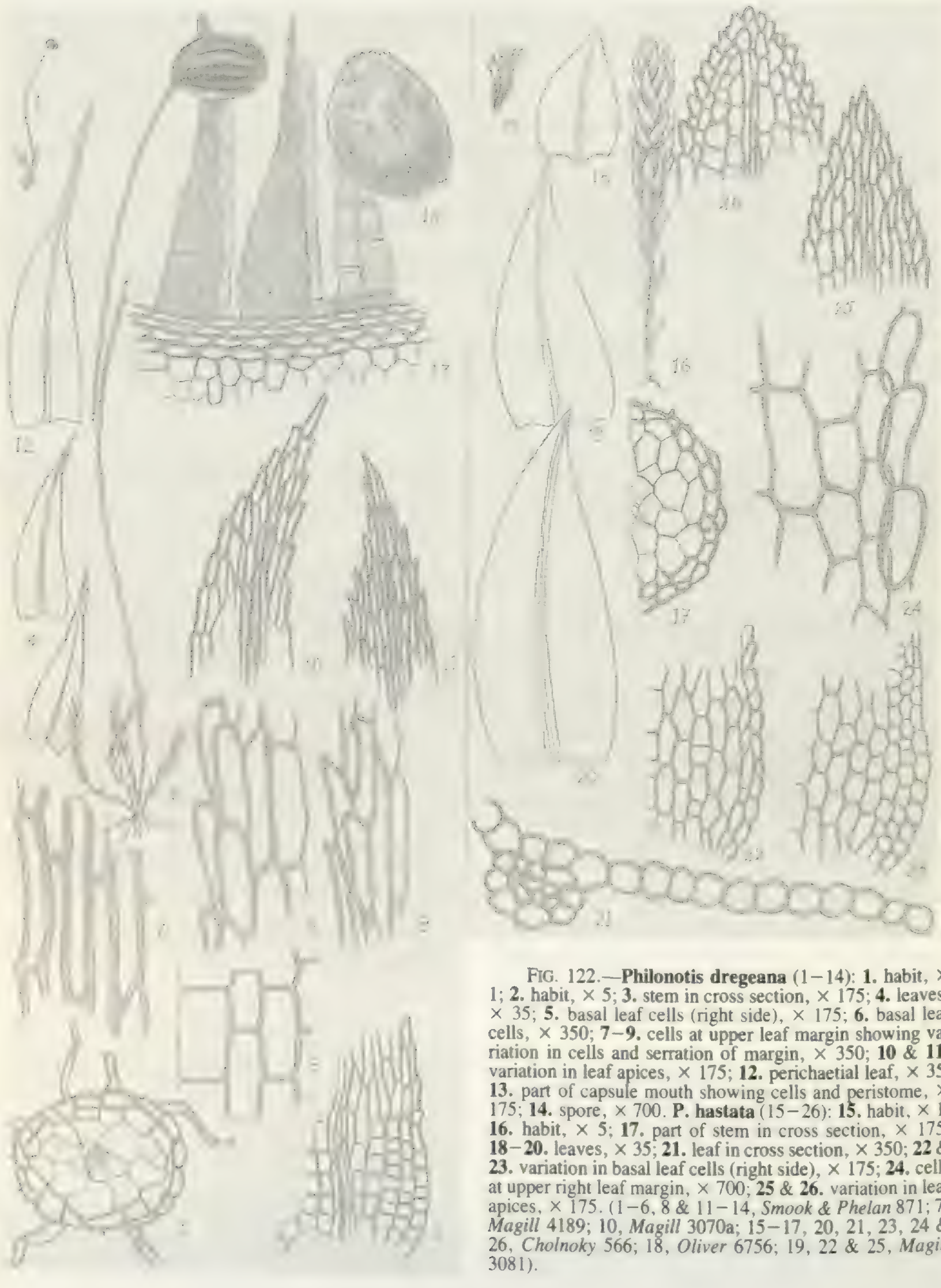


FIG. 122.—**Philonotis dregeana** (1–14): **1.** habit, × 1; **2.** habit, × 5; **3.** stem in cross section, × 175; **4.** leaves, × 35; **5.** basal leaf cells (right side), × 175; **6.** basal leaf cells, × 350; **7–9.** cells at upper leaf margin showing variation in cells and serration of margin, × 350; **10 & 11.** variation in leaf apices, × 175; **12.** perichaetial leaf, × 35; **13.** part of capsule mouth showing cells and peristome, × 175; **14.** spore, × 700. **P. hastata** (15–26): **15.** habit, × 1; **16.** habit, × 5; **17.** part of stem in cross section, × 175; **18–20.** leaves, × 35; **21.** leaf in cross section, × 350; **22 & 23.** variation in basal leaf cells (right side), × 175; **24.** cells at upper right leaf margin, × 700; **25 & 26.** variation in leaf apices, × 175. (1–6, 8 & 11–14, *Smook & Phelan* 871; 7, *Magill* 4189; 10, *Magill* 3070a; 15–17, 20, 21, 23, 24 & 26, *Cholnoky* 566; 18, *Oliver* 6756; 19, 22 & 25, *Magill* 3081).

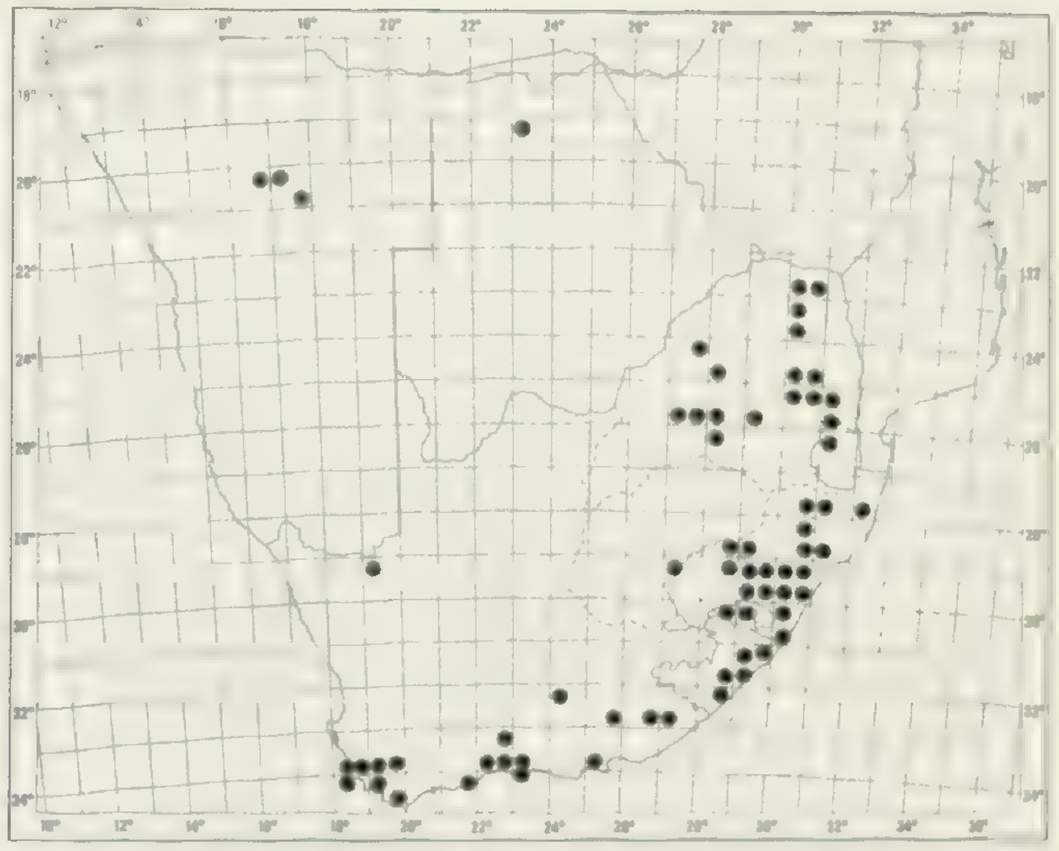
ventral superficial cells rectangular, ± smooth, dorsal superficial cells rectangular, prorate; in section rounded, guide cells 2, ventral cells in single layer, thickened, dorsal cells in 2−3 layers, not strongly differentiated, incrassate, occasionally 1−2 rows below guide cells slightly smaller. *Laminal cells* narrowly rectangular, 5−10: 1, thin-walled to strongly thickened, occasionally weakly flexuose, appearing smooth but some cells weakly prorate on dorsal surface; basal cells quadrate to short-rectangular, 1−2: 1, thin-walled, slightly bulging, smooth, forming ± distinct group.

Autoicous. Perigonia terminal on stem or branch; leaves oval-acuminate, acumen abruptly reflexed. Perichaetia terminal but overgrown by subperichaetial innovations; leaves abruptly acuminate above concave, oval base, 1,25 mm long. *Seta* (8−)10−14 mm long, yellow-brown; capsule inclined, globose to ovoid wet, 2 mm long, sulcate dry; exothecial cells short-rectangular to oblong-hexagonal, becoming quadrate above, 4−6 rows at mouth transversely rectangular, brownish; stomata present at base of urn, phaneropore; *peristome* double, exostome teeth 16, narrowly triangular, 0,3 mm high, weakly papillose, endostome variable and fragile, papillose, yellowish, segments alternating with teeth, cleft and perforated, almost as long as teeth, cilia single; operculum not seen; spores subround, 30−37 μm, strongly papillose, brownish. Fig. 122: 1−14.

The most commonly collected species of *Philonotis* in southern Africa, *P. dregeana* is also reported from Zimbabwe. In the Flora area *P. dregeana* is collected in mountain grasslands or shrublands of the northern, central, southern and eastern Transvaal, Swaziland, Zululand, eastern Orange Free State, Lesotho, Natal, Transkei and the eastern, central, southern, southwestern and northwestern Cape. A few specimens are also known from central South West Africa/Namibia and Botswana. Map 169.

Vouchers: *Brenan* M2800; *Cholnoky* 84, 817; *Crosby & Crosby* 7655; *Magill* 3458, 5900; *Oliver* 7134; *Volk* 1051; *Wells* 78.

The species is identified by its recurved, doubly serrate leaf margins and ± distinct group of basal leaf cells; however the list of synonyms indicates the variation expressed by the species. These type specimens suggested the presence of several distinct elements, however more recent collections clearly indicate that a broader circumscription of the species is necessary. For example specimens of *P. afrouncinata* appear distinct from *P. dregeana*, because of narrow, strongly thickened upper laminal cells that accentuate the thin-walled basal cells. The type of *P. afrouncinata* is however at the extreme end of the variation in leaf cell thickenings, while the type of *P. androgyna* is at the other, with *P. dregeana* in between.



MAP 169.— ● **Philonotis dregeana**

Another problem is that most collections without sporophytes appear to have either terminal perigonia or perichaetia although Hampe called his plant *P. androgyna!* Careful examination of plants with and without sporophytes indicated that, although young plants may have only terminal perigonia, older specimens had perigonia (or more rarely perichaetia) terminating subperichaetial innovations. The subsequent elongation of the branches and deterioration of the sporophyte masked the autoicous condition.

The type of *P. afrocapillaris* is an unusual specimen with narrowly lanceolate leaves. The leaves were consistently less than 2 mm long so Sim's measurements of 2−3 mm are apparently in error. Although the specimen does not correspond in all respects to *P. dregeana*, the elongated stems and distant leaves indicate environmentally induced modification of this specimen.

2. **Philonotis hastata** *(Duby) Wijk & Marg.* in Taxon 8: 74 (1959); Gangulee, Moss. E. India 4: 1127 (1974); Iwatsuki in Proc. Bryol. Soc. Japan 2: 13−15 (1977). Type: Java, Tjappus, *Zollinger* 1813 (L).

Hypnum hastatum Duby in Moritzi, Syst. Verz. Zoll. Pfl. 132 (1846).

Bartramia laxissima C. Müll., Syn. Musc. 1: 480 (1848), nom. illeg. *Philonotis laxissima* (C. Müll.) Mitt. in J. Linn. Soc., Bot. Suppl. 1: 61 (1859), nom illeg.; Fleisch., Musci Fl. Buitenzorg 2: 614 (1904); Broth. in Natürl. PflFam. 10: 463 (1924); Sim, Bryo. S. Afr. 307 (1926). Type: Assam, *Griffith* s.n.

Philonotis imbricatula Mitt. in J. Linn. Soc., Bot. Suppl. 1: 61 (1859); Fleisch., Musci Fl. Buitenzorg 2: 616 (1904); Broth. in Natürl. PflFam. 10: 462 (1924); Sim, Bryo. S. Afr. 308 (1926).

Philonotis obtusata C. Müll. ex Ren. & Card. in Bull. Soc. r. Bot. Belg. 34: 61 (1895); Broth. in Natürl. PflFam. 10: 463 (1924); Sim, Bryo. S. Afr. 308 (1926). Type: Madagascar, Ambositra, *Soula* s.n. [Borgen] (PC!).

Philonotis zuluensis Broth. & Bryhn in Forh. Vidensk-Selsk. Krist. 1911 (4): 16 (1911); Broth. in Natürl. PflFam.

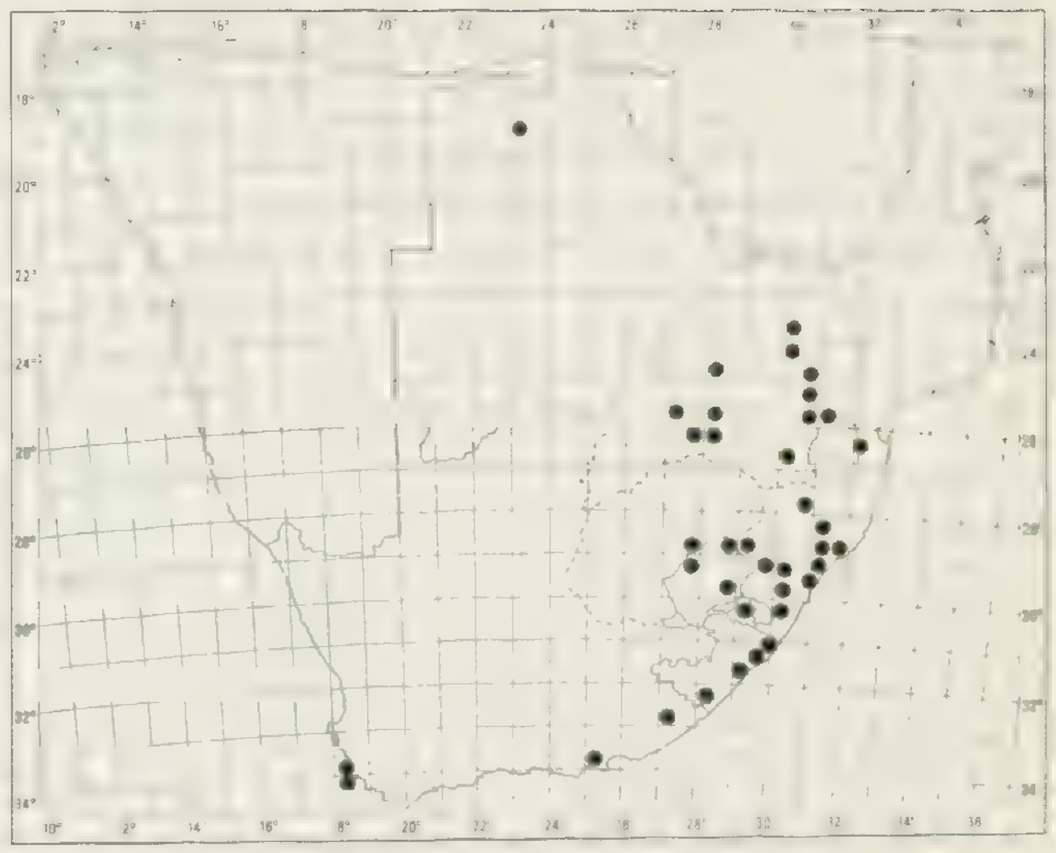
10: 462 (1924). Type: Zululand, Eshowe, *Bryhn* s.n., Jan. 1909 (H!).

Plants small, loosely caespitose, light green to yellow-green; terricolous or saxicolous. *Stems* 10−20(−30) mm long, infrequently branched; in section round, central strand present, inner cortical cells in 2−3 rows, thin-walled, outer cortical cells in 2−3 rows, thickened, reddish or yellowish, epidermal cells quickly eroded. *Leaves* appressed dry, erect-spreading wet; ovate-lanceolate to ovate-acute, 0,4−1,2 mm long; apex acute to occasionally broadly acuminate or rarely rounded; margins plane to occasionally reflexed, coarsely crenulate by projecting cell ends. *Costa* ending below apex or occasionally percurrent in some leaves; superficial cells rectangular, weakly prorate; in section bulging dorsally, guide cells 2, incrassate, ventral cells in single layer, ± larger than guide cells, thin-walled, dorsal cells in small group of 4−6 cells, incrassate, dorsal surface cells slightly larger than ventral cells, thin-walled. *Laminal cells* rectangular to weakly oblong-hexagonal, 2−4: 1, thin-walled, occasionally some quadrate, smooth or occasionally weakly prorate-papillose; basal cells more regularly quadrate or infrequently short-rectangular, smooth.

Only single immature capsule seen; perichaetia terminal; *seta* 16 mm long; capsule horizontal, globose, 2,2 mm long; exothecial cells short-rectangular, weakly thickened; operculum convex. Fig. 122: 15–26.

Philonotis hastata is found in southern Asia, Australia and Oceania, South and Central America, eastern and southern Africa, Madagascar and a few of the East African Islands. In southern Africa, the species is most frequently collected in Natal, Zululand and the eastern Transvaal. Specimens have also been collected in the central and southern Transvaal, Swaziland, eastern Orange Free State, Lesotho, Transkei, the eastern, southern and southwestern Cape and Botswana. Map 170.

Vouchers: *Cholnoky* 581; *Magill* 3081, 3590, 4239; *Schelpe* 7552; *Smith* 2810; *Stirton* 6957; *Van Rooy* 490, 1829.



MAP 170.— ● **Philonotis hastata**

The species is identified by its generally short, ovate to ovate-lanceolate leaves with acute apices, costa ending below the apex and bluntly crenulate leaf margins. The species is, however, quite variable, especially in leaf length and shape of the apex. It could be confused with *P. dregeana*, but that species has regularly narrow-rectangular laminal cells, narrower leaves and costa short-excurrent.

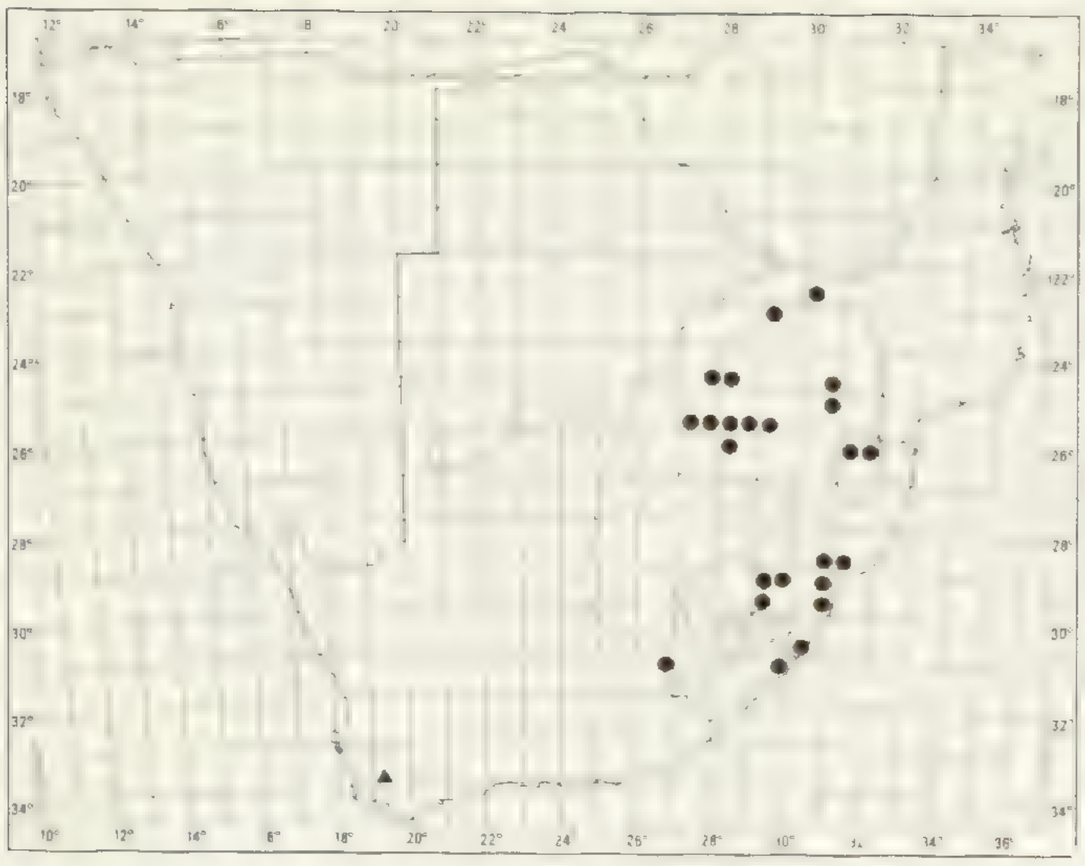
The type of *P. obtusata* was examined and found to differ in having rounded apices. Some of the leaves on the same stem were either obtuse or rarely almost acute, therefore it was concluded that the rounded apices represent only an environmental modification; a few southern African specimens (*vide* Sim, 1926) also exhibit the same modification.

3. **Philonotis africana** *(C. Müll.) Par.*, Ind. Bryol. Suppl. 264 (1900); Broth. in Natürl. PflFam. 10: 461 (1924); Sim, Bryo. S. Afr. 310 (1926). Type: Natal, Inanda, *Rehmann* 193 (PRE!).

Bartramia africana C. Müll. in Hedwigia 38: 93 (1899).

Plants small to medium-sized, loosely caespitose, yellow-green; terricolous or saxicolous. *Stems* 20−30(−50) mm high, branches few, tomentum on lower stem, red-brown; in section round, central strand small, inner cortical cells in 3−4 rows, weakly thickened, outer

FIG. 123.—**Philonotis africana** (1−8): **1.** habit, × 1; **2.** habit, × 5; **3.** stem in cross section, × 175; **4.** leaf, × 70; **5.** leaf in cross section, × 350; **6.** basal leaf cells, × 175; **7.** cells at upper right leaf margin, × 700; **8.** leaf apex, × 175. **P. falcata** (9−16): **9.** habit, × 1; **10.** habit, × 5; **11.** part of stem in cross section, × 175; **12.** leaves, × 35; **13.** leaf in cross section, × 350; **14.** basal leaf cells (left side), × 175; **15.** leaf apex, × 175; **16.** cells at upper right leaf margin, × 700. **P. scabrifolia** (17−25): **17.** habit, × 1; **18.** habit, × 10; **19.** part of stem in cross section, × 350; **20.** branch leaves, × 35; **21.** leaf in cross section, × 350; **22.** basal leaf cells (right side), × 175; **23.** leaf apex, × 175; **24.** cells at upper leaf margin, × 700; **25.** stem leaf, × 35. **P. vagans** (26−33): **26.** habit, × 1; **27.** part of upper stem, × 5; **28.** part of stem in cross section, × 175; **29.** leaf, × 35; **30.** leaf in cross section, × 175; **31.** basal leaf cells (right side), × 175; **32.** leaf apex, × 175; **33.** cells at upper left leaf margin, × 175. (1−8, *Smook* 823; 9−16, *Magill* 4241; 17−25, *Magill* 4299; 26−33, *Esterhuysen* 25392).



MAP 171.— ● **Philonotis africana**
▲ **Philonotis vagans**

cortical cells in 2 rows, cells smaller, incrassate, red-yellow, epidermal cells quickly eroded, stem ± fluted. *Leaves* appressed dry, erect-spreading wet; ovate-acuminate to lanceolate, 1,0−1,5 mm long; apex acuminate; margins recurved to revolute or occasionally some leaves plane, serrate by prorate marginal cells. *Costa* percurrent and filling acumen to short-excurrent, ventral and dorsal superficial cells rectangular, prorate; in section bulging dorsally, guide cells 2−3, incrassate, ventral surface cells in single layer, thickened, dorsal stereid band small, cells in 2−3 rows, dorsal surface cells smaller than ventral cells, incrassate. *Laminal cells* rectangular, 2−7: 1, weakly thickened, prorate to near base, mostly on ventral surface; basal cells short-rectangular; alar cells quadrate, smooth.

Sporophyte not known. Fig. 123: 1–8.

Endemic to southern Africa, *P. africana* is known from the northern, central, eastern and southern Transvaal, Swaziland, Zululand, Natal, Transkei and the eastern Cape. Map 171.

Vouchers: *Brenan* M2818; *Cholnoky* 131; *Magill* 3044, 3742; *Smook* 826.

The reflexed leaf margins on most leaves, distinctly prorate leaf cells and lanceolate to ovate-lanceolate leaves should place specimens of *P. africana*.

4. **Philonotis falcata** *(Hook.) Mitt.* in J. Linn. Soc., Bot., Suppl. 1: 62 (1859); Broth. in Natürl. PflFam. 10: 465 (1924); Ochi in Nova Hedw. 4: 97 (1962); Gangulee, Moss. E. India 4: 1110 (1974). Type: Nepal, *Buchanan* s.n. (BM).

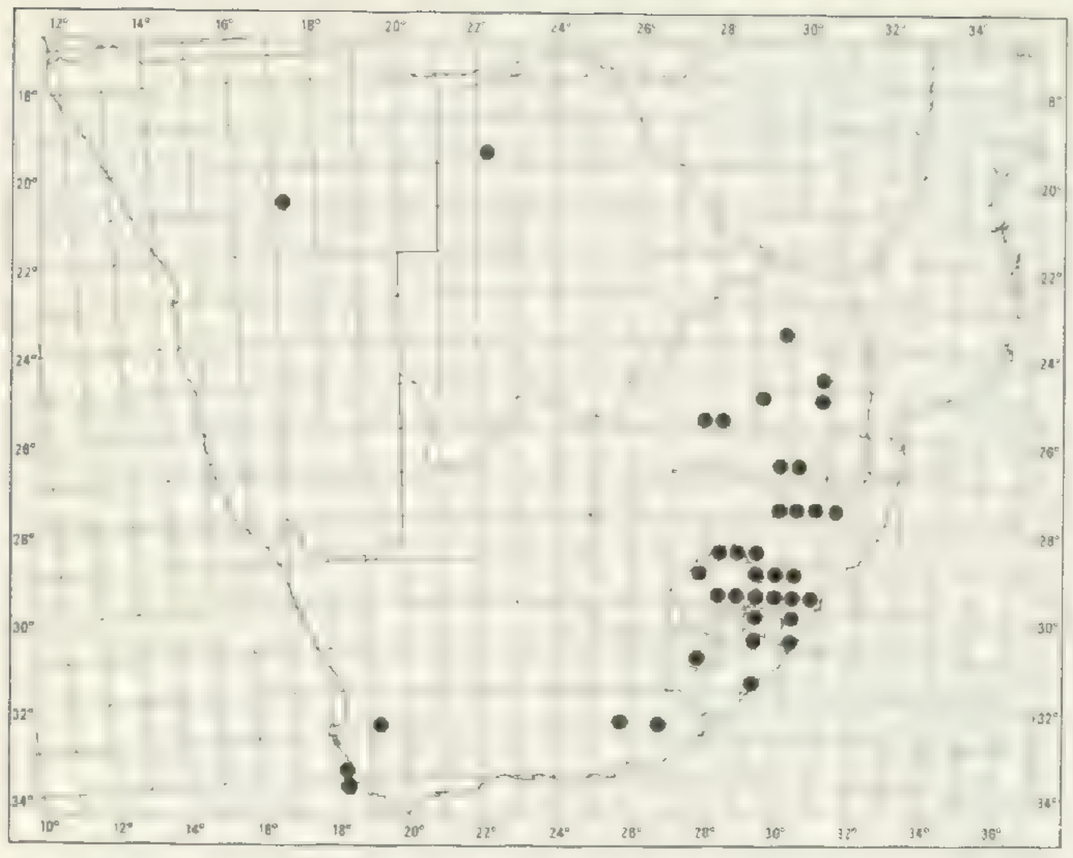
Bartramia falcata Hook. in Trans. Linn. Soc. Lond. 9: 317 (1808).

Bartramia afrofontana C. Müll. in Hedwigia 38: 93 (1899). *Philonotis afrofontana* (C. Müll.) Par., Ind. Bryol. Suppl. 264 (1900); Broth. in Natürl. PflFam. 10: 465 (1924); Sim, Bryo. S. Afr. 310 (1926). Syntypes: Cape, Boschberg, *MacOwan* s.n., 1873 (GRA!); Transvaal, Sand River, *Wilms* s.n., Aug. 1884 (G); Orange Free State, Caledon River near Kadziberg, *Rehmann* 192 (PRE!).

Plants small to medium-sized, caespitose, green to yellow-green, brownish below; terricolous or saxicolous. *Stems* 20−50 (−80) mm high, branching by subperichaetial innovation, tomentose below, red-brown; in section round, central strand large, inner cortical cells in 2−3 rows, large, thin-walled, ± thickened toward outside, outer cortical cells in 2 rows, incrassate or substereids, yellow-brown, epidermal cells large, thin-walled, ± inflated, fragile. *Leaves* widespreading to squarrose, ± contorted dry or rarely incurved, widespreading wet, keeled; ovate-acuminate, (1,0−)1,2−1,5 mm long; margins plane, serrate above. *Costa* short-excurrent, ventral and dorsal superficial cells long-rectangular, prorate; in section bulging dorsally, guide cells 3−4, incrassate, ventral stereid or substereid band weak, occasionally absent, ventral surface cells incrassate, dorsal stereid band stronger, 2−4 cells thick, cells occasionally substereids, frequently with distinct gap below central guide cells, dorsal surface cells incrassate. *Laminal cells* rectangular, 1,5−3,0: 1, generally weakly thickened, prorate ventrally at distal or proximal ends; basal cells rectangular, ± bulging, prorate except at insertion.

Dioicous. Perigonia terminal; leaves broadly oval, abruptly narrow-acuminate. Perichaetia terminal, overgrown by numerous subperichaetial innovations; leaves oval to oblong, abruptly narrow-acuminate, to 2 mm long. *Seta* 25−35 mm long, red-yellow; capsule inclined to suberect, urn globose to ovoid, 2,5 mm long, weakly striate dry, red-yellow; exothecial cells hexagonal to rhomboidal or angular, thickened, 6 rows at capsule mouth transversely rectangular, reddish; stomata present at base of urn, phaneropore; *peristome* double, exostome teeth 16, narrowly triangular, fragile, finely papillose, endostome with segments alternating with teeth, perforated, cilia 2−3, ornately papillose; operculum not seen; spores subround, 27−30 μm, papillose, brownish. Fig. 123: 9−16.

Philonotis falcata is known from Asia, India and Africa. In southern Africa, the species is frequently collected in Natal and Lesotho, and occasionally found in



MAP 172.— ● **Philonotis falcata**

South West Africa/Namibia, Botswana, the Transvaal, Zululand, Transkei and the eastern, central and southwestern Cape. Map 172.

Vouchers: *Cholnoky* 618, 830; *Killick* 1131; *Magill* 4625; *Pienaar* 53; *Smith* 2833.

The usually larger plants, distinctly prorate leaf cells and keeled leaves, that are generally folded lengthwise in micropreparations, will help to identify this species.

South African specimens of *P. laeviuscula* Dix. have been included here, although more research into the relationship between the two species is needed. The specimens are somewhat larger in size and leaf length, the leaf cells are laxer and marginal cells larger. These modifications seem to be environmentally produced, and the specimens not distinct enough from *P. falcata* to recognize another species for the group. One of the syntypes of *Bartramia squarrifolia* (*Moss* s.n., PRE-CH9388) would fall into this group and is quite similar in size and structure to the type of *P. laeviuscula*.

5. **Philonotis scabrifolia** (Hook. f. & Wils.) Braithw., Brit. Moss Fl. 2: 215 (1893); Broth. in Natürl. PflFam. 10: 464 (1924); Sim, Bryo. S. Afr. 305 (1926); Sainsb., N. Zeal. Mosses 312 (1955); Scott & Stone, Moss. S. Austr. 338 (1976); Catcheside, Moss. South Austr. 289 (1980). Type: New Zealand, Auckland Isl., *Hooker* s.n. (BM).

Bartramia hymenodon C. Müll. in Bot. Ztg 17: 220 (1859). *Philonotis hymenodon* (C. Müll.) Jaeg. in Verh. St Gall. naturw. Ges. 1873–74: 78 (1875); Broth. in Natürl. PflFam. 1: 649 (1904). Type: Cape, Olifantshoek, *Ecklon* s.n.

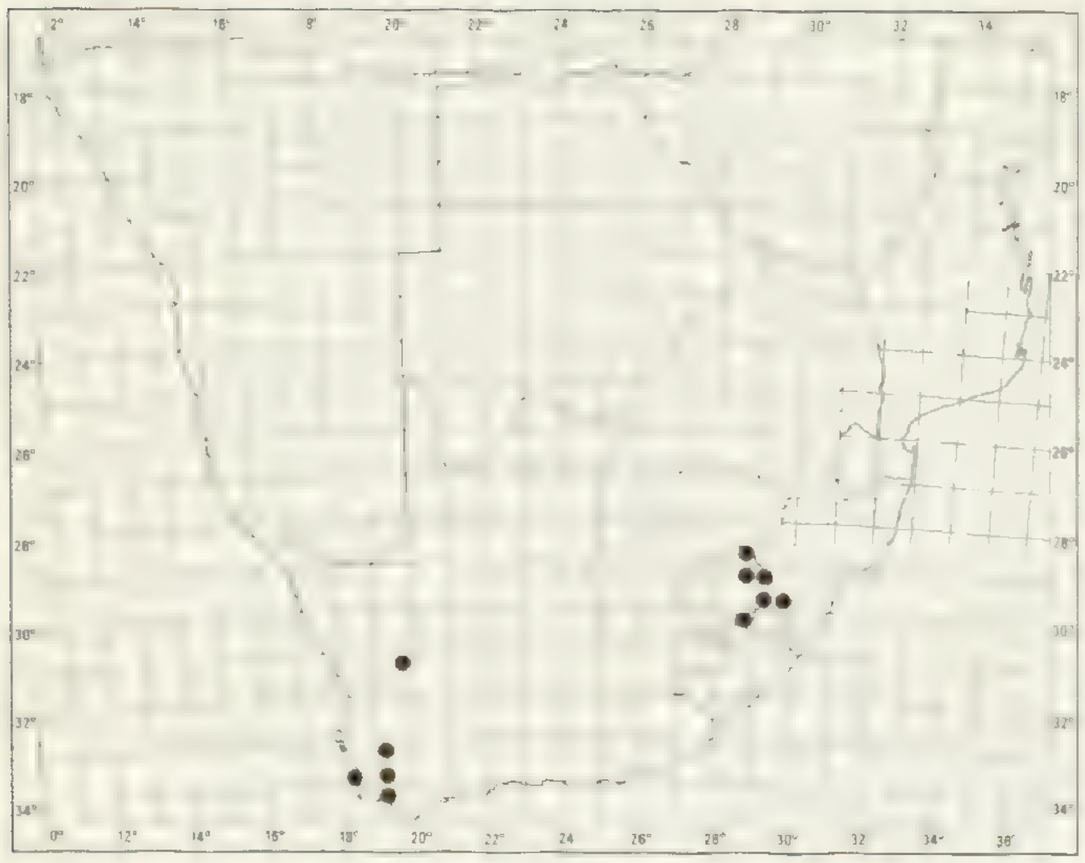
Plants small, scattered or loosely caespitose, light green to yellow-green, brownish below, stem and leaves covered with glaucous bloom; saxicolous or corticolous. *Stems* 10–40 mm tall, frequently branched, especially above, larger plants ± dendroid, tomentum sparse on lower stem, red-brown; in section round, central strand large, inner cortical cells in 3–4 rows, large, thin-walled, outer cortical cells in 2–3 rows, incrassate, yellowish-brown, epidermal cells quickly eroded, stem weakly fluted. *Leaves* appressed to spreading, weakly contorted dry, spreading wet; ovate to lanceolate, 0,5–1,0 mm long; apex acute to acuminate; margins plane to reflexed, crenulate by projecting leaf cell papillae. *Costa* short-excurrent as brownish awn, ventral and dorsal superficial cells long-rectangular, prorate; in section bulging dorsally, guide cells 2, incrassate, ventral cells in single row, smaller than guide cells, dorsal substereid band 2–3 cells thick, dorsal surface cells similar to ventral cells. *Laminal cells* quadrate to hexagonal, rectangular or rhomboidal, mostly 1–2: 1, thin-walled, papillose with one large, spinose papilla over lumen of either dorsal or ventral surface; basal cells not differentiated.

Dioicous. Perigonia terminal, discoid; leaves with broadly obovate clasping base, abruptly constricted to a squarrose-reflexed acumen; costa percurrent to short-excurrent. Perichaetia terminal, quickly overgrown by subperichaetial innovations; leaves oblong to elliptical, constricted to a long, narrow acumen, 2,2–2,5 mm long; costa long-excurrent. *Seta* 5–7 mm long, reddish yellow; capsule inclined, assymetrical, urn ovoid, 2 mm long, striate wet or dry, red-brown; exothecial cells rectangular to rhomboidal, thin-walled, 2–4 rows of transversely rectangular cells at mouth, reddish; stomata present at base of urn, phaneropore; *peristome* double, exostome teeth narrowly triangular, 0,35 mm high, weakly papillose, red-yellow, endostome irregularly cleft and perforated, segments as long as teeth, cilia absent, smooth, yellowish; operculum convex; calyptra not seen; spores rounded, 27–28 μm, papillose, brownish. Fig. 123: 17–25.

A widespread species in the Southern Hemisphere, *P. scabrifolia* is known from Central and South America, southern Africa, Australia, New Zealand, subantarctic Islands and Oceania. In southern Africa the species is found in rock recesses or shallow caves in the mountains of the western Cape and Drakensberg of Lesotho and Natal. Map 173.

Vouchers: *Esterhuysen* 25685; *Magill* 4295, 4467; *Schelpe* 8028; *Van Zanten et al.* 7609927.

The plants are easily identified by the glaucous bloom on stems and leaves, dendroid habit of the small plants, and its growth in rock crevices and shallow caves. The short leaf cells with a large, spinose papilla are also distinctive.



MAP 173.— ● **Philonotis scabrifolia**

6. **Philonotis vagans** *(Hook. f. & Wils.) Mitt.* in J. Linn. Soc., Bot. 4: 80 (1859); Broth. in Natürl. PflFam. 10: 469 (1924); Clarke in Br. Antarct. Surv. Bull. 37: 58 (1973); Robinson in Smithson. Contr. Bot. 27: 43 (1975). Type: South America, Cape Horn, Hermite Isl., *Hooker* s.n. (BM).

Bryum vagans Hook. f. & Wils. in Hooker, Lond. J. Bot. 3: 546 (1844). *Bartramia vagans* (Hook. f. & Wils.) Mitt. in J. Linn. Soc., Bot. 12: 262 (1869).

Plants medium-sized to large, loosely caespitose, yellow-green; saxicolous. *Stems* 20−50 mm high, irregularly branched, weakly tomentose below; in section round, central strand present, inner cortical cells in 3−4 rows, large, thin-walled, outer cortical cells in 1−2 rows, smaller, incrassate, yellowish brown, epidermal cells somewhat fragile. *Leaves* appressed-incurved to spreading and somewhat contorted dry, erect-spreading wet; broadly ovate-acuminate, 2,5−3,0 mm long; margins plane, serrate above mid-leaf, bordered by 4−8 rows of narrow, incrassate cells, in section border cells rounded, smaller than laminal cells. *Costa* short-excurrent as toothed apiculus, ventral and dorsal superficial cells long-rectangular, ± flexuose, incrassate, smooth; in section elliptical, guide cells 4, incrassate, ventral cells in single row, smaller than guide cells, incrassate, dorsal stereid band small, 2 cells thick, dorsal surface cells substereids. *Laminal cells* rectangular to oblong-rhomboidal, bulging, weakly thickened, 2−5: 1, smooth; marginal cells in 4−8 rows, linear, 15−25: 1, incrassate, forming distinct border; basal cells not differentiated; alar cells in single row of 4−5 enlarged cells, broadly rectangular, becoming narrower above and merging with border.

Sporophyte not known. Fig. 123: 26−33.

New to southern Africa, the species is also known from southern South America and a few subantarctic islands. In the Flora area *P. vagans* has been collected in the mountains of the southwestern Cape. Map 171.

Voucher: *Esterhuysen* 25392.

A very unusual and distinct species not closely related to the other southern African taxa. *Philonotis vagans* might be mistaken for a species of *Bryum;* however, the costal anatomy, oblong laminal cells, strong leaf border and differentiated alar cells will help to identify the species.

8. BREUTELIA

Breutelia *(B.S.G.) Schimp.*, Coroll. Bryol. Eur. 85 (1856); Broth. in Natürl. PflFam. 10: 469 (1924); Sim, Bryo. S. Afr. 311 (1926); Sainsb., N. Zeal. Mosses 307 (1955); Gangulee, Moss. E. India 4: 1101 (1974); Scott & Stone, Moss. S. Austr. 330 (1976); Catcheside, Moss. South Austr. 286 (1980). Type species: *B. arcuata* (Sw.) Schimp.

Bartramia sect. *Breutelia* B.S.G., Bryol. Eur. 4: 1 (1851).

Plants medium-sized to large, frequently robust, caespitose; terricolous or saxicolous. *Stems* erect, irregularly and sparsely branched, generally with reddish tomentum on lower stem; in section round, central strand present, epidermal cells fragile, stem fluted. *Leaves* plicate; oval- to ovate-acuminate or long-acuminate above obovate base, rarely broadly elliptical; lamina unistratose, plicae only in base or extending to upper leaf, strong or weak; margins plane to recurved, serrate. *Costa* short- or long-excurrent. *Laminal cells* rectangular to long-rectangular, incrassate, prorate or papillose at proximal end of cell, rarely almost smooth; basal cells strongly to weakly differentiated; alar cells frequently forming ± distinct group.

Dioicous. Perigonia terminal, red-brown. Perichaetia becoming lateral through innovation. *Seta* elongate; capsule inclined; urn globose to ovoid wet, short-cylindrical and sulcate dry; peristome double, endostome rudimentary; operculum convex to short-conic; calyptra cucullate; spores with wart-like plates.

Approximately 120 species of *Breutelia* are presently recognized from tropical and temperate regions, primarily of the Southern Hemisphere. The major centre of described species is South America.

Breutelia is separated from the other genera of Bartramiaceae by the generally larger size and robustness of the plants and plications of the leaf base or lamina.

1 Lamina reflexed above obovate, sheathing base; leaves strongly plicate throughout ..... 1. *B. diffracta*
1 Lamina not reflexed above strongly differentiated base; leaves plicate only in base *or* plicae weak above:
2 Plants large or robust; leaves 4−6 mm long:
3 Leaves elliptical to broadly ovate; margins ± plane ..... 3. *B. elliptica*
3 Leaves oval-acuminate, margins recurved to narrowly revolute below ..... 2. *B. tabularis*
2 Plants smaller; leaves to 3 mm long:
4 Leaves rigidly appressed dry, broadly ovate-acuminate; alar cells numerous, quadrate to short-rectangular, incrassate ..... 4. *B. substricta*
4 Leaves patent to spreading dry, narrowly lanceolate; alar cells not strongly differentiated ..... 5. *B. angustifolia*

1. **Breutelia diffracta** *Mitt.* in J. Linn. Soc., Bot. 7: 153 (1863); Broth. in Natürl. PflFam. 10: 472 (1924); De Sloover in Bull. Jard. bot. nat. Belg. 45: 248 (1975). Type: Cameroon, *Mann* s.n. (NY!).

Bartramia subgnaphalea C. Müll. in Flora, Jena 73: 480 (1890). *Breutelia subgnaphalea* (C. Müll.) Par., Ind. Bryol. 154 (1894); Broth. in Natürl. PflFam. 10: 472 (1924); Sim, Bryo. S. Afr. 313 (1926); fide De Sloover in Bull. Jard. bot. nat. Belg. 45: 248 (1975). Type: Tanzania, Kilimanjaro, *Meyer* s.n., 1889.

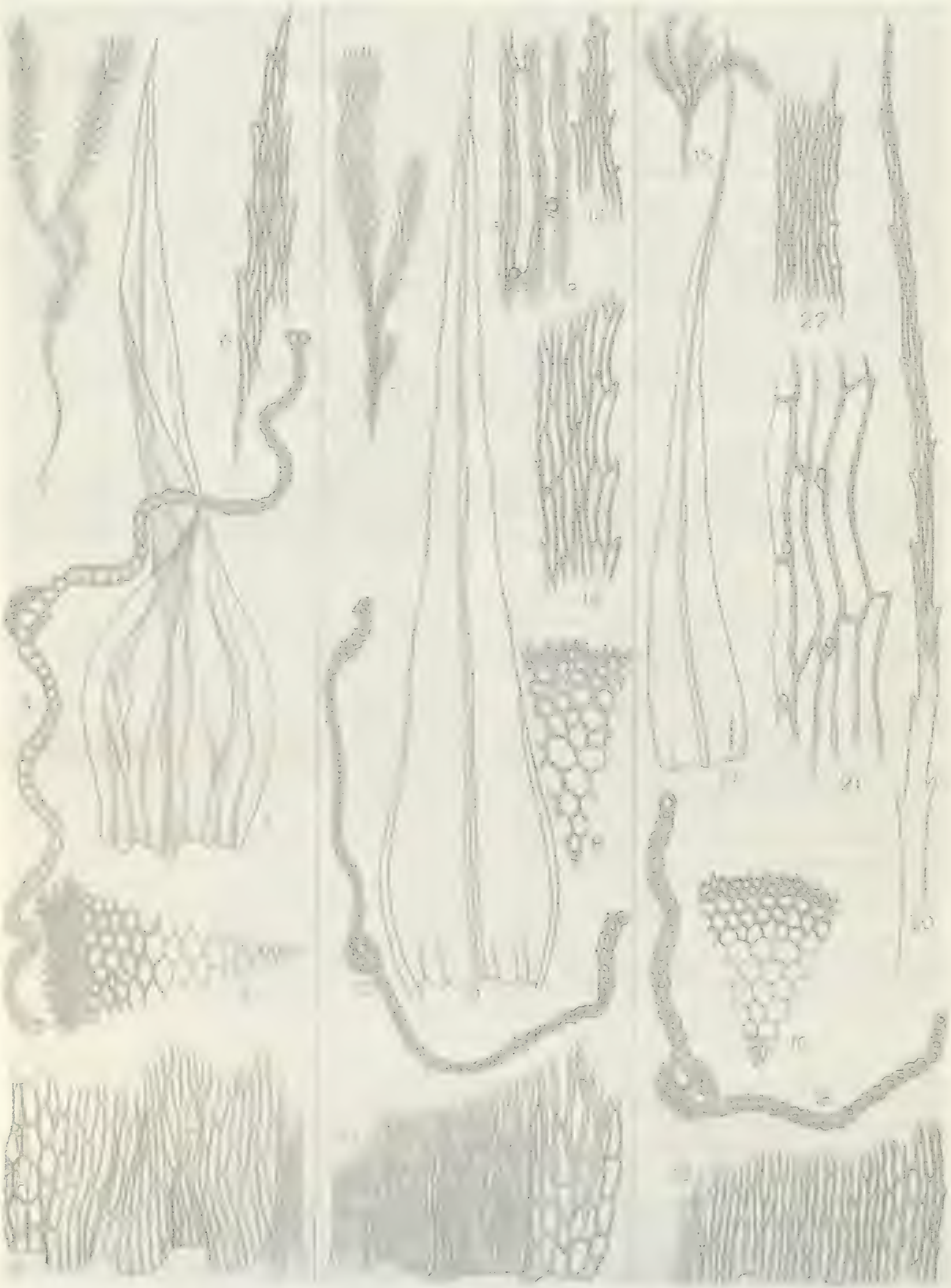
Plants medium-sized to large, frequently robust, forming large, loose cushions, yellowish green, brownish below; terricolous or saxicolous. *Stems* 50−150(−200) mm tall, irregularly branched, generally with dense reddish brown tomentum on lower stem; in section elliptical, central strand present, small, inner cortical cells in 8−12 rows, thin-walled, smaller and more strongly thickened toward outside, outer cortical cells in 2−3 rows, stereids, reddish, epidermal cells thin-walled, fragile, outer wall quickly broken away resulting in fluted stem. *Leaves* ± distant, lamina widespreading to squarrose above erect, sheathing base, weakly contorted dry, strongly plicate from base to upper leaf; long-acuminate above short-obovate base, 3,0−4,0(−4,5) mm long, 1,0−1,5 mm wide at shoulders; lamina occasionally with small bistratose patches not associated with plications; margins plane, serrate to strongly serrate above base, occasionally with double teeth. *Costa* short-excurrent, serrate, superficial cells rectangular, smooth, incrassate; in section elliptical, guide cells large, incrassate, ventral stereid band 1−2(−3) cells thick, exposed, occasionally substereids, dorsal stereid band 3−4 cells thick, occasionally substereids, dorsal surface cells undifferentiated or frequently substereids. *Laminal cells* rectangular, weakly thickened, ends rounded, 5−7: 1, cells rarely strongly thickened, cells prorate at proximal ends, or occasionally with single papillae at proximal end; inner basal cells moderately differentiated, rectangular, 10: 1, strongly thickened at insertion; alar and lower marginal cells distinct, broad and lax.

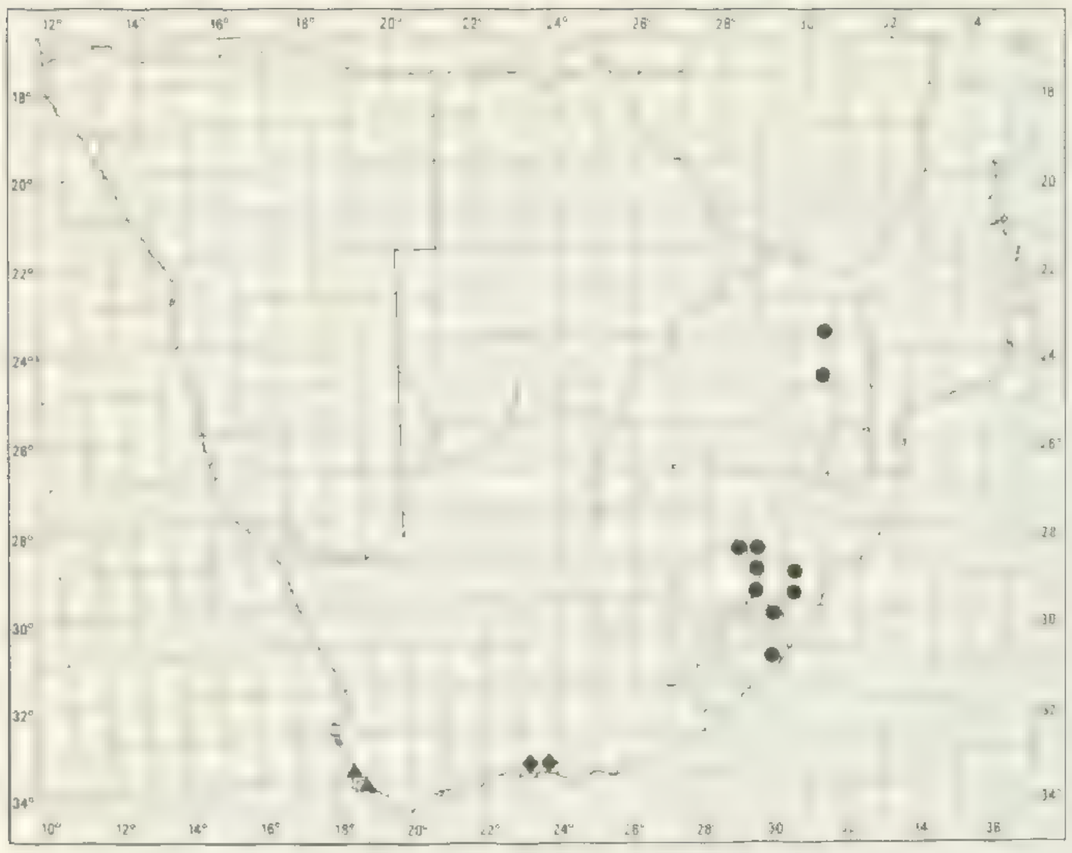
Dioicous. Perichaetia lateral through innovation. *Seta* 10−15 mm long, red-yellow; capsule inclined, urn globose to ovoid wet, urceolate and striated dry, 3−4 mm long; exothecial cells quadrate to hexagonal, weakly thickened, yellowish, 6 rows at mouth transversely rectangular, reddish; stomata not seen; *peristome* absent; operculum convex; calyptra not seen; spores subround, 30−40 μm, surface with irregular wart-like plates, red-brown. Fig. 124: 1−6.

The species is known from central and southern Africa. In the Flora area *B. diffracta* is collected in wooded kloofs and open mountain slopes of the Drakensberg of Natal, Lesotho, Transkei and the eastern and northern Transvaal. Map 174.

Vouchers: *Crosby & Crosby* 9213; *Hilliard & Burtt* 10197; *Magill* 4523; *Perold* 3a; *Zambatis* 791.

Specimens of *B. diffracta* are quickly identified by their large size and strongly plicate leaves with lamina reflexed above a differentiated, ± sheathing base. The plications are so pronounced that the lamina is wavy in cross-section. The





MAP 174.— ● **Breutelia diffracta**
▲ **Breutelia tabularis**
◆ **Breutelia elliptica**

other southern African species of *Breutelia* have only weak plications that are restricted to the leaf base.

2. **Breutelia tabularis** *Dix.* ex *Sim,* Bryo. S. Afr. 449 (1926). Syntypes: Cape, Table Mountain, Platteklip Ravine, *Sim* 9277; north of Woodhead Reservoir, *Pillans* 3335, 4899 (all PRE!).

Plants large, robust, forming cushions, yellow-green to dark green; terricolous or saxicolous. *Stems* 80−120 mm high, irregularly branched, with sparse, red-brown tomentum on lower stem; in section subround to angular, central strand small, inner cortical cells in 8−10 rows, thin-walled, becoming smaller and thickened toward outside, outer cortical cells in 2 rows, stereids, reddish, epidermal cells thin-walled, quickly absent, stem fluted. *Leaves* ± crowded, erect-spreading to widespreading and little altered dry, widespreading wet, plicate only in extreme base; oval-acuminate, 4,4−5,5 mm long, 1,2−1,5 mm wide below; base scarcely differentiated, oval to weakly obovate; margins recurved to narrowly revolute, serrate to sharply serrate above mid-leaf. *Costa* percurrent to short-excurrent; superficial cells rectangular, smooth, incrassate; in section elliptical, bulging dorsally, guide cells 2, large, incrassate, ventral stereid band 1 cell thick, exposed, dorsal stereid band 1−2 cells thick, exposed. *Laminal cells* long-rectangular, 5−10: 1, strongly thickened and pitted on lateral walls, end wall thinner, prorate proximally; 8−12 marginal cells slightly larger than laminal cells (obvious only in cross-section); basal cells long-rectangular, 10: 1, strongly incrassate; alar cells broader, quadrate to rectangular, thin-walled, usually 3 cells wide by 7 cells high.

Only immature sporophyte seen; seta to 15 mm long, capsule to 3 mm long; operculum short-conic. Fig. 124: 7−14.

Endemic to southern Africa, *B. tabularis* is found in the shade of boulders on Table Mountain and mountains of the southwestern Cape. Map 174.

Voucher: *Boucher* 2208.

This is the largest of the *Breutelia* species in southern Africa. It is unlikely to be confused with any species except *B. diffracta* from which it can be separated by its weakly plicate leaves, undifferentiated leaf base and distribution.

The distribution of this species suggests that its relationship is with those of the subantarctic islands or perhaps South America. The size of the plants, however is much larger than either of the species known from Marion Island or the species seen from South Georgia. Specimens of *B. tenuifolia* (Mitt.) Par. from Tristan da Cunha are similar in size but differ in having strongly plicate leaves.

3. **Breutelia elliptica** *Magill,* sp. nov., B. magdalenae *De Sloover similis, sed forma foliorum, marginibus planis super basim, cellulis laminarum irregulariter incrassatis et porosis differt.*

Type: Cape, Prince Alfred's Pass, S of Uniondale, on soil over rock in moist kloof with *Cunonia capensis* and fynbos on slopes, 18 Jan. 1979, *Magill* 5949 (PRE, holo.; FLAS, MO, NAM).

Plants medium-sized to large, loosely caespitose, yellow-green, brownish below; terricolous. *Stems* 30−50 mm high, irregularly branched, occasionally with flagellate branches, lower stems densely tomentose, reddish; in section elliptical, central strand small, inner cortical cells in 7−8 rows, thin-walled, red-yellow, becoming incrassate toward outside, outer cor-

FIG. 124.—**Breutelia diffracta** (1−6): **1.** habit, × 1; **2.** part of stem in cross section, × 175; **3.** leaf, × 35; **4.** leaf in cross section, × 175; **5.** basal leaf cells (left side), × 175; **6.** leaf apex, × 175. **B. tabularis** (7−14): **7.** habit, × 1; **8.** part of stem in cross section, × 175; **9.** leaf, × 35; **10.** leaf in cross section, × 175; **11.** basal leaf cells (right side), × 175; **12.** laminal cells at right margin, × 350; **13.** upper laminal cells, × 700; **14.** leaf apex, × 175. **B. angustifolia** (15−22): **15.** habit, × 1; **16.** part of stem in cross section, × 175; **17.** leaf, × 35; **18.** leaf in cross section, × 175; **19.** basal leaf cells (right side), × 175; **20.** leaf apex, × 175; **21.** laminal cells at right margin, × 700; **22.** upper laminal cells at right margin, × 175. (1−6, *Magill* 4528; 7−14, *Pillans* 4899; 15, 17 & 19−21, *MacLea* sub *Rehmann* 538; 16 & 18, *Magill* 3206).

FIG. 125.—**Breutelia substricta** (1–11): **1.** habit, × 1; **2.** habit, × 5; **3.** part of stem in cross section, × 700; **4.** leaf, × 35; **5.** part of leaf in cross section, × 175; **6.** basal leaf cells (right side), × 175; **7.** laminal cells, × 700; **8.** leaf apex, × 175; **9.** capsule, dry, × 5; **10.** part of capsule mouth showing cells and peristome, × 175; **11.** spore, × 175. **B. elliptica** (12–18): **12.** habit, × 1; **13.** part of stem in cross section, × 350; **14.** leaf, × 35; **15.** part of leaf in cross section, × 175; **16.** basal leaf cells (right side), × 175; **17.** leaf apex, × 175; **18.** laminal cells, × 700. (1–11, *Barnard* 32680; 12–18, *Magill* 5949).

tical cells in 2−3 rows, stereids, reddish, epidermal cells thin-walled, fragile, stem quickly fluted. *Leaves* crowded, spreading to reflexed and contorted or twisted dry, widespreading to squarrose wet; elliptical to broadly ovate, 4−5 mm long, 1,5−1,8 mm wide; apex acute; base plicate; margins plane, serrulate to serrate above mid-leaf. *Costa* very narrow, short-excurrent; superficial cells rectangular, smooth, incrassate; in section elliptical, guide cells 4, incrassate, ventral stereid band 1 cell thick, exposed, dorsal stereid band 1−2 cells thick, dorsal surface cells undifferentiated. *Laminal cells* long-rectangular, 5−9: 1, strongly and irregularly incrassate, porose, lumens flexuose, papillae low, at proximal ends; marginal cells more evenly thickened; basal cells not distinct, smooth; alar cells forming small group, 10−12 cells extending up margins by 5 cells wide below, quadrate to short-rectangular, irregularly thickened, porose.

Sporophyte not known. Fig. 125: 12−18.

Endemic to southern Africa, this species is known from shrublands in the mountains of the southern Cape. Map 174.

Vouchers: *Esterhuysen* 21234; *Magill* 5950.

The broadly elliptical leaves of this species are distinct from the other southern African species. This species is related to *B. magdalenae* De Sloover from Réunion and Mauritius but differs in a broader leaf with obtuse, abruptly cuspidate apex, leaf margins revolute below and plane above and the cells being more irregularly thickened and porose.

4. **Breutelia substricta** *(C. Müll.) Magill*, comb. nov. Type: Cape, Groenkloof, *Breutel* s.n. (BM, holo.!).

Bartramia substricta Schimp. ex C. Müll. in Bot. Ztg 16: 162 (1858).

Bartramia afroscoparia C. Müll. in Hedwigia 38: 91 (1899). *Breutelia afroscoparia* (C. Müll.) Par., Ind. Bryol. edn 2, 1: 168 (1904); Dix. in Trans. R. Soc. S. Afr. 8: 206 (1920); Broth. in Natürl. PflFam. 10: 470 (1924); Sim, Bryo. S. Afr. 311 (1926). Syntypes: Cape, Somerset East, Boschberg, *MacOwan* s.n. (GRA!); Worcester, *Rehmann* 206 (NH!).

Bartramia afrouncinata var. *breviseta* C. Müll. in Hedwigia 38: 92 (1899). *Philonotis afrofontana* var. *breviseta* (C. Müll.) Par., Ind. Bryol. Suppl. 265 (1900); fide Sim, Bryo. S. Afr. 307 (1926). Type: Cape, Boschberg, *MacOwan* s.n. (G!).

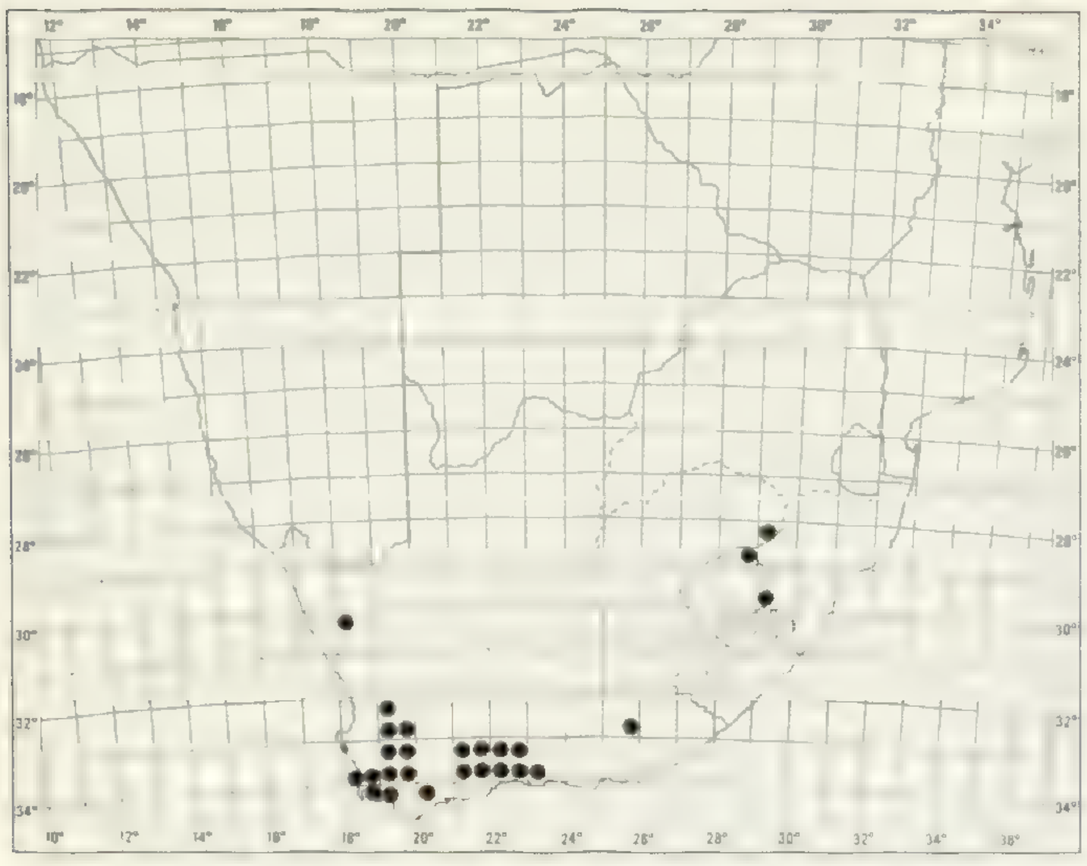
Plants medium-sized to large, loosely caespitose, yellowish green; terricolous or saxicolous. *Stems* 20−50 mm high, irregularly branched, occasionally with reddish tomentum below; in section elliptical to ± angular, central strand small, inner cortical cells in 6−10 rows, thin-walled, smaller and weakly thickened toward outside, outer cortical cells in 2−3 rows, stereids, reddish yellow, epidermal cells thin-walled, fragile, quickly broken away and stem fluted. *Leaves* ± crowded, rigidly appressed dry, erect- to widespreading wet, plicate only in lower leaf; ovate- to oval-lanceolate, (1,75−) 2,0−3,0 mm long, 0,5−1,0 mm wide in base; apex acuminate; margins recurved to revolute from base to upper leaf, serrulate to serrate above base. *Costa* short-excurrent as denticulate awn, to 0,5 mm long; superficial cells rectangular, smooth, incrassate; in section bulging dorsally, guide cells 2, large, incrassate, ventral stereid band 1(−2) cell(s) thick, exposed, dorsal stereid band strong, 3(−4) cells thick, dorsal surface cells occasionally with slightly larger lumens. *Laminal cells* long-rectangular, 5−10: 1, evenly incrassate or strongly and irregularly thickened with ± flexuose lumens, cells prorate at proximal end or infrequently papillae centred over lumen, basal cells long-rectangular, 10: 1, weakly thickened; alar cells in large, distinct group, to 10 cells wide by 20 cells high, quadrate to short-rectangular, 1−2: 1, thickened, occasionally strongly so.

Dioicous. Perichaetia lateral through innovation; leaves narrowly acuminate above oval to oblong base, 2,2−2,5 mm long. *Seta* 7−10 (−15) mm long, red-yellow; capsule ellipsoidal, striate wet or dry, 2,0−2,5 mm long, reddish yellow; exothecial cells rhomboidal, thin-walled, 2−3 rows at mouth transversely rectangular; stomata present at base of urn, subphaneropore; *peristome* double, light red-yellow, exostome teeth 16, narrowly triangular, 250 μm high, fragile, finely papillose, endostome rudimentary, consisting of irregular plates attached to exostome, smooth; operculum convex; spores rounded, 50 μm, surface with large wart-like plates, red-brown. Fig. 125: 1−11.

Endemic to southern Africa, *B. substricta* is found in shrublands and grasslands of open mountain slopes in the central, southern and western Cape, Lesotho, northeastern Orange Free State and Natal. Map 175.

Vouchers: *Cholnoky* 987, 1058; *Esterhuysen* 15780; *Killick* 4217; *Magill* 4301, 6337; *Oliver* 7327; *Rourke* 1687.

The species can be identified by its leaves rigidly erect-appressed when dry, strongly and frequently irregularly incrassate leaf cells, large alar cell group, and weakly plicate leaf base. There has, however, been considerable confusion over the proper use of this name; see note under *Anacolia breutelii*.



MAP 175.— ● **Breutelia substricta**

5. **Breutelia angustifolia** *Rehm.* ex *Sim,* Bryo. S. Afr. 312 (1926). Type: Transvaal, MacMac, *MacLea* sub *Rehmann* 538 (PRE, holo.!).

Plants medium-sized, loosely caespitose, yellowish green, brownish below; terricolous. *Stems* 10−50 mm long, branches few, occasionally with flagellate branches, tomentum sparse on lower stem, reddish; in section round, central strand present, inner cortical cells in 4−6 rows, thin-walled, red-yellow, slightly thickened toward outside, outer cortical cells in 2 rows, stereids, reddish, epidermal cells thin-walled, fragile, quickly absent and stem fluted. *Leaves* widespreading to recurved wet or dry; long-acuminate to subulate above ovate to oval base, 2,0−2,5(−3,0) mm long, 0,4−0,5 mm wide in base, plication of lamina variable and weak, plicae extending to upper leaf or very short and restricted to base, occasionally absent on some leaves; margins reflexed to recurved below mid-leaf, serrulate below, serrate above. *Costa* long- to short-excurrent as denticulate awn, 0,5−1,0 mm long; superficial cells rectangular, smooth, incrassate; in section elliptical to rounded, guide cells 2−4, thickened, ventral cells in single row, stereids or substereids, dorsal stereid or substereid band small, of 4−6 cells, dorsal surface cells substereids. *Laminal cells* long-rectangular, 5−10: 1, strongly incrassate but not pitted or nodose, prorate or papillose at proximal end of cell, occasionally almost smooth; in section surface slightly irregular; basal cells weakly differentiated, long-rectangular, 10−12: 1, weakly thickened; alar cells weakly differentiated as slightly shorter and broader cells.

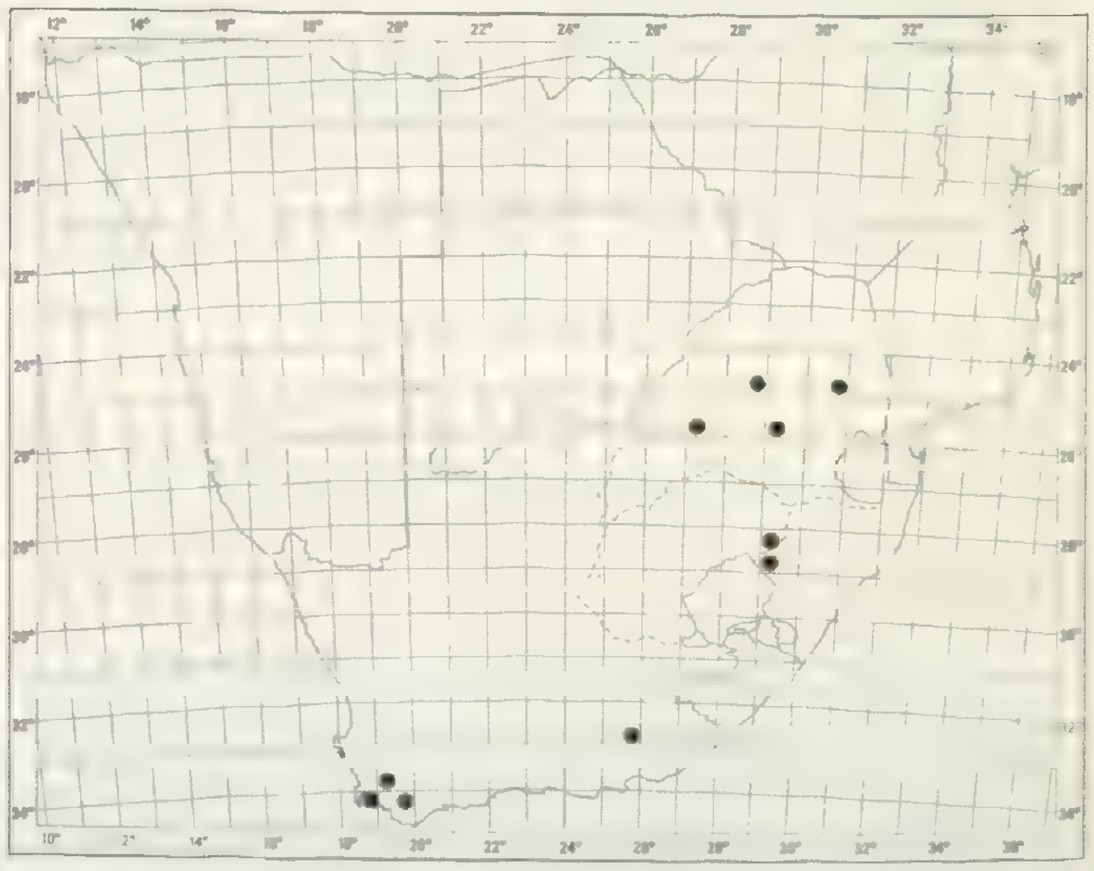
Dioicous. Perichaetia lateral through innovation; leaves oblong to oval, abruptly acuminate. *Seta* 10−15 mm long, reddish yellow; capsule symmetrical, urn globose wet, cylindrical and rugose dry, 1,2−1,5 mm long, red-yellow; exothecial cells quadrate to rectangular or angular, 5−6 rows at mouth transversely rectangular; stomata numerous at base of urn, subphaneropore; *peristome* double, fragile, only bases of teeth seen, papillose, endostome rudimentary, fragments adhering to exostome, smooth; operculum conic, minutely apiculate; spores rounded, 37−45 μm, warty, brownish. Fig. 124: 15−22.

Endemic to southern Africa, *B. angustifolia* is found in open shrublands and grasslands of the southwestern and central Cape, Natal and central and eastern Transvaal. Map 176.

Vouchers: *Esterhuysen* 15527A; *Magill* 3026; *Smook* 827.

The plants are small for *Breutelia* and might be confused with specimens of *Bartramia capensis*. The possibility of confusion is further complicated by the variability of the laminal plications. In the type and several other specimens examined, there are 2 plicae, one on each side of the leaf and displaced toward the margins. The plicae are very weak but extend to the upper part of the leaf, while in other specimens the plicae are shorter or even restricted to the extreme base. A couple of specimens even have most of their leaves smooth; it is these specimens that are problematical. A combination of characters, including leaf shape and size, long-excurrent costa, leaf cell thickening and ornamentation, and especially costal anatomy, indicates the relationship between all of the specimens and will help to identify *B. angustifolia*.

These plants might also be confused with *B. substricta*, however that species has broader leaves and strongly differentiated alar cells.



MAP 176.— ● **Breutelia angustifolia**

INDEX TO FASCICLE 2*

ANACOLIA *Schimp.* **410,** 412
abyssinica *(C. Müll.) Flow.* 411
breutelii *(C. Müll.) Magill* 410, **411,** 416, 437
var. breutelii **411**
var. squarrifolia *(Sim) Magill* **412**
menziesii *(Turn.) Par.* 411
webbii *(Mont.) Schimp.* 410
Anictangium repens Hook. 299
ANOMOBRYUM *Schimp.* **357**
drakensbergense *Van Rooy* 343, **360**
filiforme *(Dicks.) Solms* **359,** 360
julaceum *(Brid.) Schimp.* 357
promontorii (C. Müll.) Dix. 359
Archidium *Brid.* 367
acanthophyllum *Snider* 367
Atrichum *P. Beauv.* 397
AULACOMNIACEAE **405**
Aulacomnium *Schwaegr.* 405
gaudichaudii (Schwaegr.) Mitt. 405
palustre *(Hedw.) Schwaegr.* 405
turgidum *(Wahlenb.) Schwaegr.* 405
BARTRAMIA *Hedw.* 409, **412**
section *Breutelia* B.S.G. 432
africana C. Müll. 429
afrofontana C. Müll. 430
afroscoparia C. Müll. 437
afrostricta C. Müll. 411
afrouncinata C. Müll. 425
var. *breviseta* C. Müll. 437
var. *gracilescens* C. Müll. 425
androgyna Hampe 425
aristaria *C. Müll.* **416**
asperrima C. Müll. 417
breutelii C. Müll. 411
capensis *(R. Br.) Wijk & Marg.* 412, 413, **415,** 417, 438
comosa Hampe & C. Müll. 423
compacta *Hornsch.* **413,** 416, 418
var. compacta **413**
var. macowaniana *(C. Müll.) Magill* **413**
delagoae *C. Müll.* 418
dregeana C. Müll. 425
falcata Hook. 430
globosa C. Müll. 423
var. *tenuicaulis* C. Müll. 424
gracilescens (C. Müll.) C. Müll. 425
halleriana *Hedw.* 412
hampeana *C. Müll.* **417**
hampei *(C. Müll.) Catcheside* 417
hymenodon C. Müll. 431
inserta Sull. & Lesq. 415, 416
kraussii B.S.G. 413
laxissima C. Müll. 427
macowaniana C. Müll. 415
oederi Brid. 409
penicillata C. Müll. 417
pentasticha Brid. 419
pernana C. Müll. 425
quadrata Hook. 415
ramentosa C. Müll. 417
sericea Hornsch. 415
sordida C. Müll. 424
spielhausii *C. Müll.* 418
squarrifolia Sim 412, 431
stricta *Brid.* 411
subasperrima C. Müll. 413
subgnaphalea C. Müll. 433
substricta Schimp. ex C. Müll. 411, 437
vagans (Hook. f. & Wils.) Mitt. 432
BARTRAMIACEAE **407**
BARTRAMIDULA *B.S.G.* **423**
comosa *(Hampe & C. Müll.) Broth.* **423**
globosa *(C. Müll.) Broth.* **423,** 425
var. *tenuicaulis* (C. Müll.) Sim 424
wilsonii *B.S.G.* 423
BRACHYMENIUM *Schwaegr.* **341,** 361
acuminatum *Harv.* **343**
angolense *(Welw. & Duby) Jaeg.* **347**
borgenianum Hampe 343
campylotrichum (C. Müll.) Broth. 347
dicranoides *(Hornsch.) Jaeg.* **342,** 367
exile (Doz. & Molk.) Bosch. & Lac. 343, 369
julaceum Hornsch. 345
koratranum (C. Müll.) C. Müll. 345
leptophyllum *(C. Müll.) Jaeg.* 342, 348
liliputanum (C. Müll.) Broth. 342
lonchopus P. Varde 343
neesii (C. Müll.) Par. 342
napalense *Hook.* 341, 342, **347,** 348
pallidojulaceum (C. Müll.) Par. 343
pulchrum *Hook.* **345,** 347

* Synonyms are in italics.

rigidum *Broth. & Par.* 348
variabile Dix. 348
BREUTELIA *(B.S.G.) Schimp.* **432**
afroscoparia (C. Müll.) Par. 411, 437
angustifolia *Rehm.* ex *Sim* **438**
arcuata *(Sw.) Schipm.* 432
aristaria (C. Müll.) Broth. 416
var. *plumosa* Sim 415, 418
breutelii (C. Müll.) Broth. 411
diffracta *Mitt.* **433,** 435
elliptica *Magill* **435**
magdalenae De Sloover 437
spielhausii (C. Müll.) Par. 418
subgnaphalea (C. Müll.) Par. 433
substricta *(C. Müll.) Magill* 411, **437,** 438
tabularis *Dix.* ex *Sim* **435**
tenuifolia *(Mitt.) Par.* 435
BRYACEAE **335**
BRYUM *Hedw.* 342, 354, 359, **361,** 388, 432
acuminatum Sim 373
afroalpinum Rehm. ex C. Müll. 371
afronutans C. Müll. 353
albopulvinatum *C. Müll.* 366
alpinum *Huds.* ex *With.* **371,** 388
andicola *Hook.* **384**
angolense Welw. & Duby 347
appressum *Ren. & Card.* 381
arachnoideum C. Müll. 366
argenteum *Hedw.* 355, 361, **365,** 369
var. *australe* Sim 365
var. *lanatum* (P. Beauv.) Hampe 366
var. *proliferum* Sim 365
var. *rotundifolium* Sim 341, 363
var. *viride* Sim 365
aterrimum C. Müll. ex Sim 373
aubertii *(Schwaegr.) Brid.* **387,** 391
aulacomnioides C. Müll. 378
var. *limbatum* Sim 378
bicolor *Dicks.* 343, **366,** 369
billardieri *Schwaegr.* 387
brachymeniaceum C. Müll. 378
caespiticium *Hedw.* **377**
campylotrichum C. Müll. 347
canariense *Brid.* **381,** 387, 388
canariensiforme Dix. 381
capensiargenteum C. Müll. 365
capillare *Hedw.* 348, 367, **372,** 375, 388
cellulare *Hook.* 341, 355, **363,** 371
commersonii (Schwaegr.) Brid. 392
condensatum *Hampe* 387
decurrens C. Müll. 378
decursivum C. Müll. 373
dicranoides Hornsch. 342
donianum *Grev.* **379**
ecklonianum C. Müll. 353
erythrocarpum *Schwaegr.* 369, 387, 388
erythrocaulon *(Schwaegr.) Brid.* **383**
filiforme Dicks. 359
gemmiparum *De Not.* 372
herpetineuron Thér. 384
humidulum Sull. & Lesq. 353
keniae C. Müll. 389
koratranum C. Müll. 345
laxogemmaceum *C. Müll.* 387
leptoblepharon C. Müll. 351
leptophyllum Bruch & Schimp. ex C. Müll. ... 348
leucothrix C. Müll. 391
liliputanum C. Müll. 342
lonchopyxis C. Müll. 373
macleanum *C. Müll.* 387
microerythrocarpum *C. Müll. & Kindb.* **369**
mielichhoferiacea C. Müll. 351
mildeanum *Jur.* 372
miniatum *Lesq.* 372
muehlenbeckii *B.S.G.* 372, 388
mundtii C. Müll. 381, 383
neesii C. Müll. 342
nitens *Hook.* **371**
oranicum C. Müll. 365
orthodontum P. Beauv. 333
pallidojulaceum C. Müll. 343
pappeanum *C. Müll.* 388
perlimbatum *Card.* **384**
pervirens C. Müll. 381
philonotula C. Müll. 354
pocsii Bizot 363
polytrichoideum *C. Müll.* 388
polytrichoideum sensu Sim 379
porphyreothrix C. Müll. 373
prionotes *Shaw* 388
promontorii C. Müll. 359
pseudophilonotula C. Müll. 354
pseudotriquetrum *(Hedw.) Gaertn., Meyer & Schreb.* 377, **378,** 379
pumiliroseum Dix. 384
pycnophyllum *(Dix.) Mohamed* **385**
radicale Rehm. ex Dix. 375
radiculosum *Brid.* **367**
rigidicuspis Dix. 366, 367
roseum (Hedw.) Gaertn., Meyer & Schreb. ... 391

simii Schelpe 373, 375
stellipilum C. Müll. 365
stenophyllum *Dix.* 372
subcavifolium Dix. 367, 369
subdecursivum C. Müll. 367, 369
torquescens *Bruch* ex *De Not.* 348, **373,** 379, 385
torquescentulum C. Müll. 373
var. *nutans* C. Müll. 373
transvaaloalpinum *C. Müll.* 388
truncorum sensu Sim 385
truncorum (Brid.) Brid. var. *pycnophyllum* Dix. 385
turbinatum *(Hedw.) Turn.* **375,** 378
umbraculum Bruch ex Hook. 393
vagans Hook. f. & Wils. 432
viridescens *Welw. & Dub.* **379,** 383, 388
voeltzkowii Broth. 387
wilmsii C. Müll. 371
zierii Hedw. 354
zuluense Broth. & Bryhn 369
CHAMAEBRYUM *Thér. & Dix.* 299, **301**
pottioides *Thér. & Dix.* **301**
CONOSTOMUM *Sw.* **418**
arcticum *Sw.* 418
pentastichum *(Brid.) Lindb.* **419**
CYGNICOLLUM *Fife & Magill* **314**
immersum *Fife & Magill* 314, **315**
Desmatodon *Brid.* 301
Dicranaceae 355
Dicranella *(C. Müll.) Schimp.* 355
Diplostichum africanum C. Müll. 399
longirostre (Brid.) Mont. 399
Entosthodon Schwaegr. 319, 320
ampliretis C. Müll. 320
bergianus (Hornsch.) C. Müll. 323
bergii Bruch & Schimp. 323
campylopodioides C. Müll. 325
cavifolius Mitt. 321
clavata Mitt. 326
dixonii Sim 325
gracilescens C. Müll. 320
limbatus C. Müll. 320
longicollis Mitt. 325
marginatus C. Müll. 320
var. *obtusatus* Sim 321
micropyxis C. Müll. 320
plagiostomus (C. Müll.) Sim 329
rivale Geheeb 327, 329
rottleri (Schwaegr.) C. Müll. 325
schinzii Geheeb 327, 329
spathulatus (C. Müll.) Sim 329
templetonii (J.E. Sm.) Schwaegr. 319
urceolatus Mitt. 326
EPHEMERACEAE **305**
Ephemerella nervosa Dix. 307
rehmannii C. Müll. 307
EPHEMERUM *Hampe* 301, **305**
capense *C. Müll.* **305**
crassinervium *(Schwaegr.) Hampe* 307
diversifolium *Mitt.* **308**
namaquense *Magill* **307**
nervosa (Dix.) Schelpe 307
piliferum *Shaw* 309
rehmannii *(C. Müll.) Broth.* **307,** 314
serratum *(Hedw.) Hampe* 305
sessile *(Bruch & Schimp.) C. Müll.* 305, 308
EUSTICHIA *Mitt.* **399**
africana (C. Müll.) Par. 399
longirostris *(Brid.) Brid.* **399**
EUSTICHIACEAE **399**
FUNARIA *Hedw.* 311, 318, **319**
subgen. Entosthodon *(Schwaegr.) Lindb.* 320
subgen. Funaria 320
ampliretis (C. Müll.) Broth. 320
var. *obtusata* (Sim) Wijk & Marg. 321
bergiana *(Hornsch.) Broth.* **323**
cavifolia Card. & Broth. 321
clavata *(Mitt.) Magill* 320, **326**
dieterlenii Thér. 329
gracilescens Schimp. ex C. Müll. 329
gymnostoma Dix. 323, 325
harveyana Magill 321
hygrometrica *Hedw.* 319, 320, **329,** 387
limbata *(C. Müll.) Broth.* **320,** 329
lonchopelma C. Müll. 329
longicollis *Dix.* 320, **325**
marginata (C. Müll.) Broth. 320
micropyxis (C. Müll.) Broth. 320
plagiostoma C. Müll. 329
rhomboidea *Shaw* 320, **327,** 329
rottleri *(Schwaegr.) Broth.* **325,** 326
rufinervis Dix. 326
schinzii (Geheeb) Broth. 327
spathulata *Schimp.* ex *C. Müll.* 320, **329**
succuleata *(Wager & Wright) Magill* **321**
urceolata *(Mitt.) Magill* 320, **326**
FUNARIACEAE **311**
GIGASPERMACEAE **299**
GIGASPERMUM *Lindb.* **299**
breutelii (C. Müll.) Par. 299

repens *(Hook.) Lindb.* **299**
Glyphocarpa capensis R. Br. 415
Glyphocarpus capensis (R. Br.) Brid. 415
insertus (Sull. & Lesq.) Jaeg. 415
quadratus (Hook.) Brid. 415
sericeus (Hornsch.) Jaeg. 415
GONIOMITRIUM *Wils.* 301, 303, **311**
acuminatum *Hook. & Wils.* 313
africanum *(C. Müll.) Broth.* **313**
Gymnostomum subgen. *Physcomitrium* Brid. 318
capense (R. Br.) Hook. 415
niloticum Delile 314
rottleri Schwaegr. 325
spathulatum Hornsch. 318
Haplodontium *Hampe* 338
Hymenodon *Hook. f. & Wils.* 401
Hymenodontopsis *Herz.* 401
Hyophila *Brid.* 303
Hypnum hastatum Duby 427
spiniforme Hedw. 403
Leptangium breutelii (C. Müll.) Jaeg. 299
repens (Hook.) Mitt. 299
LEPTOBRYUM *(B.S.G.) Wils.* **355**
pyriforme *(Hedw.) Wils.* 355, **357**
LEPTOTHECA *Schwaegr.* **405**
gaudichaudii *Schwaegr.* **405**
Lorentziella *C. Müll.* 299
Micromitrium *Aust.* 305
MICROPOMA *Lindb.* **314**
bukobense *Broth.* 314
niloticum *(Delile) Lindb.* **314**
MIELICHHOFERIA *Nees & Hornsch.* **338,** 349
bryoides *(Harv.) Wijk & Marg.* **338,** 354
campylocarpa (Hook. & Arnott) Mitt. 399
cholnokyi P. Varde 339, 341
ecklonii Hornsch. 338, 339
rehmannii C. Müll. 338
squarrulosa C. Müll. 343
subnuda *Sim* **339**
transvaaliensis C. Müll. 338, 339
MNIACEAE **395**
Mniobryum albicans Limpr. 354
Mnium aubertii Schwaegr. 387
commersonii Schwaegr. 392
crudum Hedw. 350
ecklonii C. Müll. 395
erythrocaulon Schwaegr. 383
pseudotriquetrum Hedw. 378
roseum Hedw. 391
rostratum Schrad. 397
rostratum Schrad. var. *reidii* Dix. 395
spathulatum Hornsch. 391
spiniforme (Hedw.) C. Müll. 403
turbinatum Hedw. 375
vallis-gratiae Hampe 401
OEDIPODIELLA *Dix.* 299, **303**
australis *(Wager & Dix.) Dix.* **303**
var. catalaunica *P. Varde* 299
Oedipodium australe Wager & Dix. 303
Orthodon isleanus Besch. 331
ORTHODONTIUM *Schwaegr.* **336**
lineare *Schwaegr.* **336**
PHILONOTIS *Brid.* 423, **424**
africana *(C. Müll.) Par.* **429**
afrocapillaris Dix. ex Sim 425
afrofontana (C. Müll.) Par. 430
var. *breviseta* (C. Müll.) Par. 437
var. *gracilescens* (C. Müll.) Par. 425
afrouncinata (C. Müll.) Par. 425, 427
androgyna (Hampe) Jaeg. 425, 427
delagoae (C. Müll.) Par. 418
dregeana *(C. Müll.) Jaeg.* 424, **425,** 429
falcata *(Hook.) Mitt.* **430**
fontana *(Hedw.) Brid.* 424
hastata *(Duby) Wijk & Marg.* **427**
hymenodon (C. Müll.) Jaeg. 431
imbricatula Mitt. 427
laeviuscula Dix. 431
laxissima (C. Müll.) Mitt. 427
obtusata C. Müll. ex Ren. & Card. 427, 429
pernana (C. Müll.) Par. 425
scabrifolia *(Hook. f. & Wils.) Braithw.* **431**
transvaaloalpinum (C. Müll.) Broth. 388
vagans *(Hook. f. & Wils.) Mitt.* **432**
zuluensis Broth. & Bryhn 427
PHYSCOMITRELLOPSIS *Broth. & Wager* ex *Dix.* **317**
africana *Wager & Broth.* ex *Dix.* **317,** 319
indica Dix. 317
PHYSCOMITRIUM *(Brid.) Fuernr.* 311, 317, **318,** 321
subgen. *Cryptopyxis* (C. Müll.) Broth. 314
bergianus (Hornsch.) C. Müll. 323
brachypodium C. Müll. 318
breutelii C. Müll. 299
leptolimbatum C. Müll. 321
niloticum (Delile) C. Müll. 314
rivale (Geheeb) Broth. 327
rottleri (Schwaegr.) Hampe ex C. Müll. 325
sessile Shaw 319
spathulatum *(Hornsch.) C. Müll.* **318,** 321
var. *brevicollum* C. Müll. 318

var. sessile *(Shaw) Magill* **319**
var. spathulatum **319**
sphaericum *(Ludw.) Fuernr.* 318
succuleatum Wager & Wright 321, 323
PLAGIOBRYUM *Lindb.* **354,** 361
zierii *(Hedw.) Lindb.* **354,** 365
piliferum *P. Varde* 355
PLAGIOMNIUM *Koponen* **395**
cuspidatum *(Hedw.) Kop.* 395
rhynchophorum *(Hook.) Kop.* **395**
var. reidii *(Dix.) Kop.* **395**
rostratum (Hook.) Kop. 397
PLAGIOPUS *Brid.* **409**
crassinervius *(Mitt.) Broth.* 409
oederi *(Brid.) Limpr.* **409**
serratus *Brid.* 409
Pleuridium *Rabenh.* 301
POHLIA *Hedw.* 338, **349,** 359, 372
section Pohliella *Loesk.* 349, 350
baronii *Wijk & Marg.* **349**
cruda *(Hedw.) Lindb.* **350**
depauperata (Sim) Schelpe 350, 351
ecklonianum (C. Müll.) Jaeg. 353
elongata *Hedw.* 349, **351,** 354
leptoblepharon (C. Müll.) Broth. 351
macleai *(Sim) Schelpe* 354
mielichhoferia (C. Müll.) Broth. 351
nutans *(Hedw.) Lindb.* **353**
philonotula *(C. Müll.) Broth.* 354
proligera *(Kindb.) Broth.* 350
pseudophilonotula *(C. Müll.) Broth.* 354
revoluta Card. 371
simii Schelpe 371
zierii (Hedw.) Schwaegr. 354
Pterigynandrum longirostrum Brid. 399
PYRRHOBRYUM *Mitt.* **401**
paramattense *(C. Müll.) Manuel* 404
spiniforme *(Hedw.) Mitt.* 401, **403**
vallis-gratiae *(Hampe) Manuel* **401**
QUATHLAMBA *Magill* **421**
debilicostata *Magill* **421**
Rehmanniella C. Müll. 311
africana C. Müll. 311, 313
RHIZOGONIACEAE **401**
Rhizogonium Brid. 401
spiniforme (Hedw.) Bruch ex Krauss 403
vallis-gratiae (Hampe) Hampe ex Jaeg. 401
RHODOBRYUM *(Schimp.) Limpr.* 335, 361, 387, **388**
aubertii (Schwaegr.) Thér. 387
commersonii *(Schwaegr.) Par.* **392**
keniae *(C. Müll.) Broth.* **389**
leucothrix (C. Müll.) Broth. 391
ontariense Kindb. 391
roseum *(Hedw.) Limpr.* 388, **389**
spathulatum (Hornsch.) Pócs 391
umbraculum *(Hook.) Schimp.* ex *Par.* **392**
Schizymenium Harv. 338
bryoides Harv. 338
SPLACHNACEAE **331**
TAYLORIA *Hook.* **331**
isleana *(Besch.) Broth.* **331,** 333
orthodonta *(P. Beauv.) Demar.* 331
orthodonta *(P. Beauv.) Wijk & Marg.* **333**
splachnoides *(Schwaegr.) Hook.* 331
Webera Hedw. 349
afronutans (C. Müll.) Par. 353
annotina (Hedw.) Bruch var. *decurrens* (Ren. & Card.) Ren. & Card. 349
cruda (Hedw.) Fuernr. 350
decurrens Ren. & Card. 349
depauperata Sim 350
elongata (Hedw.) Schwaegr. 351
leptoblepharon (C. Müll.) Jaeg. 351
macleai Sim 354
mielichhoferia (C. Müll.) Par. 351
nutans Hedw. 353
pyriformis Hedw. 357
revoluta Sim 371
Weisiopsis *Broth.* 303
Weissia bergiana Hornsch. 323

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